THE CHEMICAL AGE

VOL LVI 21 JUNE 1947 No 1458

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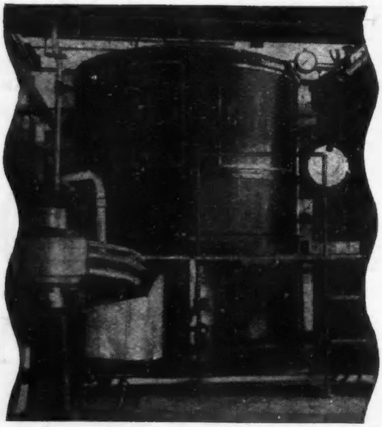

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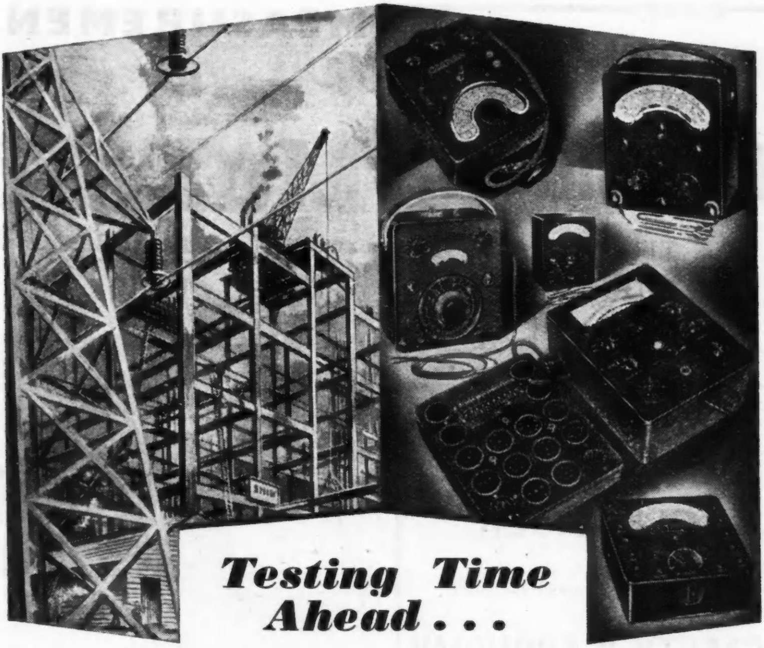

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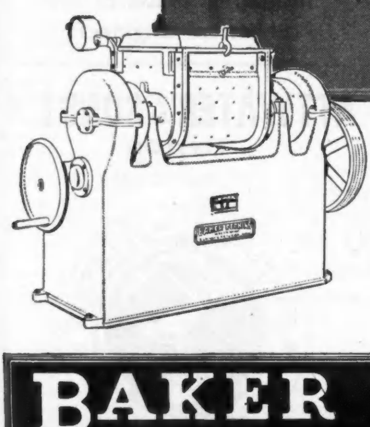

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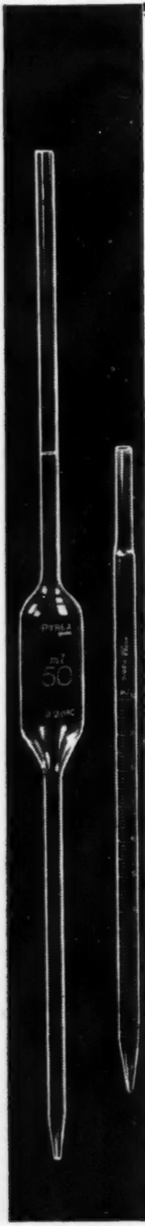

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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World Trade and Britain

A REPORTER on the staff of the Amercan magazine *LOOK* has examined Britain and has reached the conclusion, splashed wide across the columns of his paper that " Britain is dying." What, he asks, is it worth to America to save Britain? He concludes that it is worth a very great deal because " England is America's affair."

We do not necessarily agree with this verdict. We do not wish to be considered as believing that Britain is sick unto death and will die unless we get medicine from another country. There is no doubt that many mistakes are being made here. The insistence on nationalisation seems to many, probably to the majority, to be a display of energy in the wrong place. We fail to see what effect the ownership of a business has upon its financial success; that depends on the management and on everyone connected with it. If the Government had tackled the measures necessary for economic rehabilitation first, and left socialistic theories till a more convenient time, we would probably have been in a very much better position than we are in to-day. Take, for example, the coal mines—the principal nationalisation scheme that has taken so much energy that might have been devoted to the rehabilitation of industry. *LOOK* has this to say: " You would expect England would go all out to mine more coal. But the mark of slow death is clearest in the fact that she has not done so." There is no doubt that in spite of all the efforts of the Government and the National Coal Board, the only tangible result of nationalisation of the coal industry has been to reduce still further the hours of work, and to reduce still further the output of coal. That is not the way to economic recovery. There is much that we could do ourselves, much more than we are doing, and unless we do it *LOOK* will have written our epitaph.

In making this complaint against officialdom and against our own people that they do not show the will to work, let us not forget that what we are suffering, what we are about to suffer, is not only a matter for this country. We are part of the world, and the malady is world-wide. The Continent of Europe is more sick than Britain. It is torn by political factions, the standard of living in some countries is even below ours. Many parts of the Continent are faced with a dearth of essential supplies in the immediate future. This country has spent its savings of centuries and can only live if it exports at least 75 per cent more than in 1938. We are not doing so, and we are therefore faced with a gap in the means of payments for those imports without which we cannot exist. P.E.P. reporting its findings in a new book " Britain and World Trade " believes that even this export target—so far still beyond our powers—" will be adequate only if imports are not increased more than is needed for the raw material for additional exports and if there is no unfavourable movement in the 'terms of trade.' " Therefore we cannot improve our present low standard of living without an even greater effort than we have been called upon to make hitherto.

Under what conditions can we increase our exports sufficiently to restore our standard of living? First, we must have a greater volume of production a man-hour. Our labour force is too small to do what

On Other Pages

we need; we must therefore increase production per man. Second, and simultaneously, we must have plentiful supplies of raw materials. We must have coal in sufficient supply; lack of coal, the breakdown at the pits last winter, has robbed us of some £200 million worth of exports. We know of export orders that have been refused because we had not the wherewithal to manufacture them. We suffer from shortages at home for the same reason; *LOOK's* reporter says with justification: "Houses cannot be built because there is no timber, and Sweden's timber cannot be bought because there is no British coal to buy it." Third, we must have orders to execute; to obtain these we must no longer sit at home; we must send our best technical salesmen abroad to secure the necessary orders. Fourth, we must reduce our prices. So far since the end of the war we have seen no sign of price reductions, but many evidences of price increases. Our people would be better off if they had half the incomes they now have and the price of everything was halved. The more we increase prices, the less we shall sell abroad in competition.

But when all these measures have been taken—and we have serious doubts whether they will be taken unless Government policy is changed considerably—we are still faced with one fundamental difficulty. It is the difficulty of getting a better flow of international trade. The U.S.A. with a great population, vast resources and supreme manufacturing capacity can virtually be self-supporting. It is to-day the workshop of the world and its exports greatly exceed its imports. That is not healthy; the situation that is developing is parallel in some respects with that of 1930 when most of the gold in the world was "sterilised" in American bank vaults. Already there is a world shortage of dollars and it is growing much faster than was expected. That is no doubt the reason why the U.S.A. is now acting to avoid the grave economic and social distress that is looming ahead by lending abroad on a vast scale. America will make her own conditions for those loans. We trust that our Government will agree to nothing that still further weakens the Empire as a unit. The British Empire, like the U.S.A., could be self-supporting; let us place the Empire first. We are heartened by the announcement that the Government is preparing schemes for stimulating substantially the production of foodstuffs and our essential commodities in the Colonial Empire. There are many who wish to escape from the stifling conditions in this country to-day; that is their opportunity—to aid in developing the Empire's resources. Capital will be required, but that, in spite of our present poverty, should not be an insuperable difficulty. Development of the Empire will help to reduce our adverse dollar balance; we must not be tied to America when we have our own Empire that needs developing, and in which there is plenty of room for trade expansion.

That, however, is only one aspect of the problem. Fundamentally, the need of the world is for a freer flow of trade between

one nation and another. The lack of this flow of trade caused the trade depression of 1929-30. Will it cause another in 1948-49? Foreign countries all over the world need goods of every kind from us. They cannot pay for those goods and we cannot afford to wait years for our money, as we once could. Our necessary increase of exports cannot be secured unless there is an increased volume of trade generally over the whole world. Our immediate future will depend upon getting international trade going again. That does not mean that we must neglect any step that will help to make our trading position stronger. Research, development, greater production per man-hour, harder work from every man and woman, courageous development of new ventures, all these and more besides are essential if we are to preserve our place in a competitive world. But the success of these measures will depend upon getting the wheels of international trade moving again. That is the fundamental importance of the American scheme to give economic aid to nations hard hit by the war.

NOTES AND COMMENTS

New Fields

IN the introduction to his paper on "The Control of Chemical Reactions on a Large Scale," Dr. King, Director of the Gas Research Board, points out that the history of the gas industry is a story of steady progress, over a period of almost 150 years, to a present stage of high efficiency, without fundamental change in the main method of production of coal gas. Carbonisation by external heating, as introduced by Murdoch, is still the principle of the method by which most of the town gas of to-day is made, although it is true to say that the yield of gas is now augmented by the steam-carbon reaction in the case of continuous vertical retort practice. Throughout this period the chemist has played his part in improving technique, in providing adequate means of process control, and in making possible certain important forward steps, such as those which have taken place in the development of refractory materials and in the marketing of ancillary products of carbonisation. He has not, however, yet brought to the stage of manufacture any process of gas making from coal which involves a fundamental change from the conventional method of carbonisation. In the field of chemical industry the chemist has been more successful, in that his academic studies have in several instances grown to the stature of new and important industries. A popular example of this is the plastics industry, which has grown in less than one generation from the work of L. H. Baekeland. A second, and more recent example, is that of the application of catalysts on a large scale. It is not so long ago that catalysts were still in the hands of the research chemist, but now there are few industries in which they do not play some part, and many in which they are all-important.

Catalyst Ratio

IN most catalytic processes, says Dr. King, the ratio weight of raw material to catalyst is large. In the process of the catalytic refining of petroleum oil, however, where the catalyst loses activity quickly and the ratio must be small, it has been necessary to develop a means for the rapid and continuous handling of large quantities of finely divided solid catalyst. The technique of movement of fine solids has been brought to such a stage of perfection in this process that the application of a similar technique to other processes is an obvious development. The technique itself consists in the carrying of finely divided solids in an air- or gas-borne stream under conditions of fluid flow in which the motive power is provided by static head of solid and/or by gas pressure, and pumping or mechanical handling is avoided. Direct application to other catalytic processes is obviously possible, but direct application to reactions in which the finely divided solid is one component of a gas-solid reaction is of particular interest in relation to the possible gasification of coal in powdered form. Dr. King gives a brief description of the technique of oil refining by fluid-flow catalytic cracking with some indications of its possible application in the gasification of coal. It is Dr. King's belief that the technique might bring about a fundamental change in certain processes existing in, or of immediate interest to,

the British gas industry. Application in catalytic processes could be direct, but would, of course, be valuable only for reactions involving a low raw material : catalyst ratio, or the need for frequent reactivation of catalyst. The technique might also be applied to the purification of coal gas from hydrogen sulphide by powdered iron oxide. It is, however, of the greatest interest in connection with the work of the Gas Research Board on the development of a process of complete gasification of coal involving the synthesis of methane by the action of hydrogen upon coal and the gasification of coal or coke in oxygen and steam, both under pressure.

Tuesday = 100

TUESDAY saw the burial of an anachronism which for long has been making exasperating nonsense of official announcements about national standards of living. On that day was abandoned the old cost of living index and a start was made in drawing up a new one, founded on actual prices as from June 17. Bearing in mind that the cost of living scale was based upon average expenditure and prices in force before many of us were born—1904—no one will charge the Administration in this case with seeking change before it was due. Nor will it any longer have to juggle with the prices of candles in order to raise or depress the cost of living index. The new index, calculating the fluctuations on July 15, and taking prices on June 17 as the 100 per cent criterion, when it is published in mid-August will take into account many items which did not figure in the old, without which any attempt to assess the current cost of living is devoid of reality. It acknowledges at last that electricity and gas, wireless and cinemas, petrol and a host of other things make continuous charges on the average household budget; and that it is absurd when shortages are acute and prices inflated to form an intelligible evaluation against a post-(Boer)-war background. Iron and steel and those other industries whose wage agreements are adjusted according to the old index will be two months in which to adjust their wage scales. There is no such direct relationship to wages in the chemical industry, although wage negotiations are necessarily influenced by cost of living. To that extent the injection of realism is welcome—and would be doubly welcome were it accompanied by a general realisation that a stable cost of living figure cannot be preserved if wages rocket.

Alf : *Hiccups !*

Saskatchewan Potash

IN a report on the recently discovered Saskatchewan potash deposits in *Canadian Chemistry and Process Industries,* A. J. Williams states that the salt zone at one of the wells near Unity, extends from 3459 ft. to 3894 ft. to give a thickness of 435 ft. The section above 3466 ft. indicates smaller amounts of KCl. (7.3 per cent and less), while the section below 3476 ft. shows slightly smaller amounts (5.26 per cent). Average K_2O content over 130 in. (ignoring 1 in. core loss) is 21.6 per cent. Another well which is being drilled about 10 miles away, will soon be completed; it will no doubt yield further valuable information as to the extent of the deposit. An interesting and equally important feature of this well is that it provides natural gas at the rate of 2 million cu. ft. per day. Contrasting the Saskatchewan deposits with those in other parts of the world, the writer emphasises the greater mining depth of the Canadian deposits, and eulogises their bed thickness and the quality of the product. Compared with other Canadian deposits, the following points are made: The Unity deposits are all 4000 ft. nearer the surface than the others, in addition to being of better quality. They can be mined by shaft methods, whereas deeper deposits would require the brine method involving production of salt as a by-product for which there is only a limited demand. Fuel needs at the site can be met by natural gas from the same well.

With regard to market prospects, these, it is understood, will largely depend on the policy of European producers.

Control of Chemical Reactions on a Large Scale

Fluid Catalyst Process of Oil Refining : Catalytic and Gas-Solid Reactions

IN a paper read at the annual general meeting of the Institution of Gas Engineers at Birmingham recently, Dr. J. G. King, director of the Gas Research Board, discussed the possible application to processes of interest to the gas industry of a new technique in the control of chemical reactions on a full manufacturing scale. This new technique has been developed in connection with the catalytic refining of petroleum, and has already provided in that industry a means for the exact control of reaction conditions while processing very large quantities of materials.

Dr. King pointed out that the application of catalysis to the thermal cracking of oil started in about 1931, using hydrogenation under pressure. Later, however, this technique was displaced by cracking in the absence of hydrogen. Since cracking involves reduction of molecular weight, a proportion of the carbon of the oil molecule is deposited on the catalyst, and this carbon must be burned off at intervals under conditions which do not destroy catalytic activity. In the early stages of development, therefore, a unit plant embodied a number of cracking chambers which were treated in turn for the removal of carbon in order to obtain continuity of operation. These static beds of catalyst (fixed beds) were of granulated material through which pre-heated oil was passed downwards under pressure (80 lb. per sq. in.) and at about 900°F.—the Houdry and Hydroforming systems.

Movement of Catalyst

The first step towards a fluid system was a process involving the movement of a coarse-granulated catalyst countercurrent to the preheated oil, and withdrawal of the fouled catalyst continuously for " burning off." Spent catalyst, fouled with carbon, is elevated mechanically to a feed hopper of a vessel down which it passes countercurrent to an air stream which removes the carbon by combustion. The revivified catalyst is then mechanically elevated to the feed hopper of the reaction vessel, and the cycle is complete.

When true fluid-flow catalysis was first introduced, in about 1939, it represented a method of handling powdered solids in bulk which was new in the industry. The essential principle in the method of movement was the maintaining of the powder in a fluid, free-flowing condition, and circulating it by the air-lift method well known in the movement of liquids. The motive power for the circulation of the fluid was obtained from the static head of gas-solid columns and by the introduction under pressure of oil vapours to the oil-cracking reactor, and of air to the catalyst revivifier.

In the up-flow system the heated catalyst flows from a standpipe into a stream of preheated vapourised oil and is carried upwards into a reaction chamber. Since this chamber is of much greater diameter, the velocity of movement falls and a more dense turbulent bed is formed in which the solid particles are in violent motion. The entire stream is then carried over into a three-stage cyclone separator from which the oil vapours pass to a fractionating column and the solid catalyst, containing carbon, passes in a stream carried by injected air to a chamber in which the carbon is burned off. The hot catalyst then returns via the standpipe leading to the oil inlet.

Down-Flow Technique

This procedure has now been largely replaced by a down-flow technique. Revivified catalyst leaves the so-called " regenerator " by the standpipe and enters the inlet pipe to the cracking chamber, its rate of flow being regulated by slide valves. Heated oil vapours from the feed-heater enter just behind this point and carry the catalyst upwards into a cracking chamber (reactor) of large diameter, in which the velocity of flow is reduced to 1 to 2 ft. per sec. At this rate of flow the solid particles form a dense, turbulent bed with a definite boundary or surface at a certain level in the reactor. From this surface cracked vapours escape with some entrained catalyst dust. Most of this dust is returned by the internal cyclone, and clean vapours pass to the fractionating column.

The cracking reactions take place in the "reactor," the temperature being regulated by the respective temperatures and proportions of heated catalyst and oil, and the time of treatment by the rate of flow. The cracking reactions cause the catalyst to become coated with carbon, and it is withdrawn continuously, from the bottom of the dense zone, through a vessel in which it is swept with steam to remove entrained oil, into a standpipe from which it flows by gravity at a controlled rate into the inlet line to the regenerator. It is then carried upwards into the regenerator by an air stream, which also provides the oxygen for burning off the carbon. In the regenerator a dense, turbulent

bed develops which is similar to that formed in the reactor. The products of combustion from the regenerator are cycloned to return entrained solids, and pass through a waste-heat boiler and a Cottrell precipitator before leaving to atmosphere with less than 15 gr. of entrained solid per 100 cu. ft. The revivified catalyst (0.5 per cent carbon) is withdrawn through a standpipe. A second standpipe with air entrainment (air 15 lb. per sq. in.) circulates catalyst to and from the regenerator bed through a cooler, and provides a control over the temperature to which the catalyst is heated in the burning-off process. Some finely divided catalyst inevitably reaches the heavy-oil distillates from which it is recovered as a concentrated sludge by using a centrifuge. This sludge is returned to the feed line.

Large Cracking Plants

Down-flow cracking plants are now of large size, treating from 500,000 to 1 mill. imperial gal. of oil per day. Working conditions vary with raw material and product, and the catalyst/oil ratio may vary from 5:1 to 30:1, so that up to 50 tons of solids per min. may be circulated in a plant processing 1 mill. gal. of oil per day. The reactor and the regenerator are very large vessels. The former, 50 ft. high by 25 ft. diameter, operates with 75 to 100 tons of catalyst in the fluidised bed, and the latter with 150 to 300 tons. Continuity of operation for periods of eight months has been achieved.

Although the quantities of catalyst circulated are very great, losses from the system have been reduced to about 1 ton per day (0.4 lb. per 100 gal. oil), by special design of Cottrell separators, and by increasing the electrical conductivity of the dust so that it imparts its charges readily to the collection plate.

It is the down-flow fluidised technique which is of special interest in connection with gasification, as well as catalytic, processes.

In the fixed-bed process of oil cracking it was necessary that the bed should offer the minimum of resistance to the flow of oil vapour through it. This was achieved by granulation, even to the extent of making catalyst in the form of uniform beads of small size. In a fluidised system the problem is quite different. In the first place it is obvious that a finely divided powder is essential to a slow velocity of settling in an oil stream, but it might have been thought also that there would be some optimum size distribution or, at least, a minimum size to avoid gelling with very fine powders. This does not seem to be the case, and the catalyst used range in particle size from 100μ to 0.

An important advantage of the fluid technique is the high thermal efficiency which can be achieved by the transfer of heat from solid to gas within the system, with minimum loss. The quantities involved are large (up to 150 mill. B.Th.U. per hr.), and can be supplied completely by the burning off of the carbon in the regenerator and by heat recovery from the oil fractionating column. Using an oil-preheat temperature of 400° F., and assuming a cracking temperature of 1050° F., the carbon burned represents 7 to 8 per cent of the oil supplied; at a cracking temperature of 800° F. it is 5 per cent.

In other chemical processes involving catalysis the advantages quoted above are clearly of equal value. J. A. Lee, for example, has applied the method to the conversion of naphthalene to phthalic anhydride in a 5 ft. high by 30 in. diameter converter treating 400 lb. per hr.; the Harshaw Chemical Company has suggested other applications.

The particular advantage in the naphthalene process is the ready dissipation of the heat of reaction (128,000 B.Th.U. per lb. mol.), and it is evident that in other reactions where this factor is important the fluid-catalyst technique holds equal promise. A high heat of reaction means slow reaction rates unless the heat is efficiently and rapidly dissipated; it means undesirable secondary reactions unless hot-spots are prevented; it means low chemical efficiency unless most of the heat of reaction is recovered by heat exchange. The fluid-catalyst technique seems to be one answer to all these, although a high cost of catalyst might impose a limitation in some cases.

The Hydrocol Process

A second example of such a reaction is the Fischer-Tropsch synthesis of hydrocarbons from carbon monoxide and hydrogen. Considerable interest now attaches to the United States proposal to apply fluidisation to this reaction, using natural gas as the source of the synthesis-gas mixture ($2H_2$ + CO). The great oil companies of the United States have already made considerable progress in this direction, and a number of plants are under construction to operate the Hydrocol Process of Hydrocarbon Research Incorporated, producing mainly gasoline, with diesel oil and alcohols as secondary products. Carthage Hydrocol, Brownesville, Texas, is planning to build one plant to process 64 mill. cu. ft. of natural gas per day and to produce 200,000 gal. of gasoline, 40,000 gal. of diesel oil, and 10,000 gal. of alcohols. Costs as low as 6 cents per United States gal, are forecast (capital charges 50, raw materials 20, per cent). Other companies, including the Standard Oil Company of Indiana, also propose to instal plants of Hydrocarbon Research Incorporated design, and it is understood that

Standard Oil, New Jersey, actually has one plant in operation.

P. C. Keith (president of Hydrocarbon Research Incorporated) has outlined the advantages of the fluid flow of catalysts. He recognises that the economics of the project depend upon the production of cheap oxygen to provide the synthesis gas (by partial combustion of $CH_4 \rightarrow 2H_2 + CO$), and he claims improvements in the Linde-Frank! air-separation process (liquefaction) which will provide oxygen of 90 per cent purity at the low figure of 4.8 cents per 1000 cu. ft. (excluding power costs). The oxygen plant is stated to include a new design of reversing heat exchanger to employ turbine expansion, and to employ a more simple cycle than the Linde-Frankl. A low cost of oxygen can obviously be obtained by including the oxygen plant in a factory scheme in which power is provided by waste heat; it seems improbable, however, that the gross cost of oxygen will be less than 30 cents per 1000 cu. ft. Since the fluid technique involves large quantities of catalyst, it is proposed to employ an iron synthesis catalyst in place of the more expensive and less available cobalt so largely used in Germany.

The new technique has also obvious relevance to the research work on methane synthesis which is being carried out by the Gas Research Board. As this work has developed, more than one method for the control of the heat of reaction and the achievement of a high space velocity has been proved successful. It is possible, however, that control by fluidisation would offer an alternative method for really large-scale operation.

Gas-Solid Reactions

The movement of powdered solids by the fluid-flow technique could conveniently be used either in systems in which the solid acts as an absorbing agent, removing one or more constituents from the gas stream, or as one component of a gas-solid chemical reaction. The former is easy to visualise, the absorption taking place in the reactor, and desorption for the recovery of the material in the regenerator. The conditions of a gas-solid reaction in which gradual destruction or conversion of the solid to gas takes place are less easy to visualise, since the solid particles would change their mass, and might change their density, as reaction proceeded. This rather suggests that a reactor to accommodate a gas-solid reaction of this type would necessitate more than one stage in order to complete the consumption of the solid.

A gas-solid reaction of interest to the gas industry, and in which a gas component could be removed by chemical combination with the solid, is the removal of hydrogen sulphide from town gas, using powdered iron oxide, the oxide being regenerated by the removal of the sulphur, e.g., by oxidation. Of most immediate interest to the Gas Research Board, however, is the possibility of applying the technique to the gasification of fine coal (i) by oxygen and steam, and (ii) by hydrogen under methane-forming conditions, as in the Board's own investigations at Poole. Such reactions are of the third type described above, in that the size of the solid particles of coal is subject to change either by inflation due to caking and swelling, or by reaction to form gas, or both, and that either change will affect the stability of fluidised beds and the balancing of pressures.

The Winkler Gas Generator

The first reaction has already been attempted under fluidised conditions, and on a very large scale, in the Winkler gas generator. Operating at atmospheric pressure, this generator gasifies small-grade brown coal (under 5 mm.) in a stream of oxygen and steam passing at a sufficient rate to fluidise the bed. Very high rates of gasification are achieved, 2 mill. cu. ft. per hr. of 305 B.Th.U. gas being made in one generator of 8 to 9 ft. diameter. For hydrogen manufacture, pure oxygen and a large proportion of steam are used, and the fuel and oxygen consumptions are 42 lb. and 270 cu. ft., respectively, per 1000 cu. ft. of gas composition, CO_2, 18; CO, 42; H_2, 37; CH_4, 1, per cent. The high content of CO_2 is an obvious weakness in the process, which only a two- or three-stage operation could correct. The dust carried by the gas stream is removed in a cyclone extractor and used as boiler fuel. No attempt has been made to operate at a high pressure, in which case the gas velocities would be much lower. Keith has, however, made reference to experiments which he has carried out in the United States on the direct gasification of both caking and non-caking bituminous coals. Without giving details, he has stated that gas can be produced in this way at a cost "much less than" that of coal gas made by the carbonisation of coal.

The difficulties inherent in gasifying coal or bituminous material by a gas-solid reaction of this type, will not, however, be solved easily. As stated above, the main difficulties are associated with progressive alteration of the particle-size of the solid. Other difficulties are (i) the choice of optimum size to maintain "fluid" conditions, probably in more than one stage, (ii) the compromise between height of fuel bed or number of beds and completeness of reaction, (iii) the progressive change in reaction rate as reactive material is consumed, and (iv) the removal of the ash which will concentrate in the bed.

COAL-OIL PLAN HALTED

MAXIMUM PROGRAMME ACHIEVED: FUEL MINISTER

A HALT in further prospective conversion of industrial plants from coal to oil burning was announced by the Minister of Fuel (Mr. E. Shinwell) in the House of Commons last week, which was amplified by a subsequent Press announcement by the Ministry. New applications for licences will in general not now be granted.

Mr. Shinwell, replying to a question, said "In my previous statement I explained that the annual rate of oil consumption represented by schemes of conversion already approved would be increased to 5 million tons a year, equivalent to an annual saving of coal of 8 million tons by the middle of 1948. This programme, which is the maximum that can be achieved in that time, has been reviewed, and the Government have decided against any further general extension of the programme for the time being. The matter will, however, be considered again in the autumn when the trend of coal output will be more clearly established.

Million Tons More

"In the meantime, to provide in appropriate cases for applications that are now awaiting consideration, arrangements will be made to import another 1 million tons of oil a year. After meeting these cases there will be some margin for special cases where it can be shown that the amount of coal saved would be exceptionally high in proportion to the amount of oil burnt, but no other new applications can be entertained. The additional import of 1 million tons of oil a year will not begin to be available before the third quarter of 1948, but it is not anticipated that most of the firms whose applications may now be authorised will be able to complete conversion before that quarter; any exceptional case where earlier conversion is possible will be given special consideration.

No New Licences

"In the result, unless it is decided in the autumn to increase the whole programme, the consumption of fuel oil on coal/oil conversion projects will attain a rate of 6 million tons a year and will result in an annual saving of 10 million tons of coal by the calendar year 1949."

The Ministry of Fuel later stated that the applications for conversions already received are being examined, and that the applicants will be informed individually as quickly as possible whether or not an allocation of fuel oil can be made in their case. No further approach to the Ministry is necessary. Special cases where exceptional economies would result from coal/oil conversion should be presented to the regional offices of the Ministry. The heavy demand for steel, it was indicated, was at present the limiting factor.

FULL PRODUCTION AT LAPORTE'S

At the annual general meeting of B. Laporte, Ltd., on June 18, Mr. O. P. O'Brien, the chairman, said that the company's products were in full production, with the exception of those of the barium departments which were hampered by raw material shortage. In consequence, output of hydrogen peroxide, sodium sulphide, blanc fixe, barium hydrate, barium carbonate, barium peroxide and sodium percarbonate was temporarily inadequate for present demands. Production costs continued to rise, and the company's employees now received the same wages for a 44-hour week as they formerly received for a 47-hour or 48-hour week.

Plant for the manufacture of hydrogen peroxide was being erected at Luton, and operation was expected to commence in the autumn. The extent of operations largely depended on the fuel and power position. The same could be said of the plant now being constructed for National Titanium Pigments, Ltd. Orders, valued at £250,000, have been placed for an electrolytic hydrogen peroxide plant at Warrington.

BULK BUYING FIGURES

CHEMICAL PURCHASES

A comprehensive statement of quantities and values of goods purchased in bulk from overseas by various Government departments in 1946 has been supplied by the Prime Minister in response to a question in the House of Commons by Mr. A. T. Lennox-Boyd. The statement shows that during the year purchases of chemicals accounted for 287,227 tons, valued at (f.o.b.) £3,718,281; of materials for chemicals and the manufacture of sulphuric acid 2,193,766 tons (£9,180,795 f.o.b.); of natural and synthetic rubber 443,695 tons (£57,715,597 f.o.b). Of bulk purchasing of metals the following figures were given: Chrome ore 78,150 tons (£335,000), molybdenite concentrates (delivered) 467 tons (£183,786), tungsten ore (delivered) 2700 tons (£870,166), lead 151,500 tons (£7,350,000), zinc 76,250 tons (£3,785,000), copper (blister and electrolytic) 309,400 tons (£22,580,000), tin ore 12,100 tons (£4,188,000), virgin aluminium 38,974 tons (£2,500,241), pig iron 2000 tons (£23,000), steel 939,080 tons (£11,543,309).

ACETYLENE FROM CARBON DIOXIDE

A TECHNIQUE for the conversion of small quantities of carbon dioxide to acetylene—"a preliminary to future attempts to synthesise on a very small scale biologically important compounds containing radioactive carbons C^{14} or C^{11}"—is described by Dr. W. J. Arrol and Mr. Raymond Glascock in a letter in the current issue (June 14) of *Nature*.

In our experiments—these workers record—pure barium metal was heated in a stainless steel vacuum furnace of special design in the presence of carbon dioxide, which was absorbed with the formation of barium carbide.

Quantities of ordinary inactive carbon dioxide varying from 50 to 500 microlitres at N.T.P. were measured in a McLeod gauge and transferred through a high-vacuum apparatus to the stainless steel furnace containing about 40 mgm. of barium metal which had been scraped as clean as possible before weighing.

The furnace was heated to 600°C. for 5-10 min. and all the carbon dioxide disappeared. The furnace was cooled and its contents dissolved in water. The gas mixture obtained was found to consist (apart from water vapour and hydrogen) of acetylene, ammonia formed from barium nitride and a trace of ethylene which never exceeded 2 per cent of the total C_2 hydrocarbons.

Acetylene was separated by passing the mixture through a rough drying trap at −78°C. and then adsorbing ammonia, water vapour, acetylene and the trace of ethylene from the hydrogen stream on to active charcoal at −78°C., the hydrogen being pumped away. The temperature of the charcoal was raised to 0°C., when an appreciable proportion of the acetylene (and ethylene) was desorbed: the acetylene was finally condensed into a trap connected with the McLeod gauge. No ammonia or water vapour is desorbed at this temperature during the ten minutes necessary for practically all the acetylene to be recovered.

The conversion of carbon dioxide to acetylene could be carried out in about 30 minutes. In a series of eight experiments acetylene yields varying from 79 to 98 per cent were obtained, the lower percentages occurring when smaller quantities of CO_2 were employed.

Latest thing for the dinner table is a "saltless" salt for persons requiring a salt-free diet, reports the New York *Journal of Commerce*. The new product looks like salt, tastes like salt and flows like salt—but contains no salt.

THE CHEMICAL STUDY OF PAINTS

THE behaviour of various paint constituents was reviewed by Dr. A. W. H. Barton, the speaker at the last session of the 1946-47 series of lectures arranged by the Bristol section of the Oil and Colour Chemists' Association.

Dr. Barton mentioned the raw materials used as the vehicles for emulsions, paints and quoted bituminous, wool-grease and alkyd emulsions and also the German development of vinyl polymers. One of the complications in the formulation of emulsion paints lay in the three different materials that must be used, first, the pigment, second, the dispersion phase of the vehicle, and third, the continuous phase of the vehicle. Dr. Barton dealt exclusively with the pigments, classified into inorganic, such as iron and chromium oxides, and organic, such as Hansa yellow, pigment green B and monastral blue. The first class was essentially hydrophilic, whereas the second class was essentially organophilic in the dry form and hydrophilic in the paste form. In the latter class the particle size of the pigment is of a very much lower range.

He explained by tables the effect of dispersing different pigments, both in powder and paste form, into two different vehicles, namely glue, and bentonite dispersion. The paints produced were tested for brushing properties, covering power, levelling and finishing, pigment settling, caking and emulsion breakdown. From an examination of the results of the experiments it appeared that: (a) the quantity of electrolytes in the pigments, particularly salts of strong acids, should be reduced to a minimum; (b) when using inorganic oxides, the specific gravity should be as low as possible; (c) when organic pigments are employed, they should be up to the point of application either in the oil or aqueous phases but not in both.

Dr. Barton, replying to questions in the subsequent discussion, said the bad mixing properties of Hansa yellow and monastral blue was, in his view, due to the fact that each of these paint pigment particles carried a similar electrical charge and hence a high degree of repellency might be expected.

At the annual general meeting of the Institute of Physics held on June 11, 1947, the president, Professor A. M. Tyndall; honorary treasurer, Mr. E. R. Davies, and honorary secretary, Dr. B. P. Dudding, were re-elected for the year beginning October 1, 1947. The following were elected to take office on that date: vice-president, Mr. D. A. Oliver; ordinary members of the board, Mr. N. L. Harris, Dr. T. L. Ibbs, Dr. J. H. Nelson, Dr. J. Topping.

Printing Inks from Petroleum*

PRINTING inks consist of a coloured pigment dissolved in a suitable medium, first to carry it from the ink duct via the printing plate to the paper, and second to fix the dye to the paper after printing. Petroleum can suppy both the colouring material and the medium. The mechanism by which a fluid ink becomes dry and rub-proof can take one or more of the following four forms: (a) oxidation or polymerisation; (b) absorption; (c) evaporation; (d) gelation.

There are three main methods of printing: 1, Typography (letterpress) by which the ink is applied by rollers to the raised parts of type or blocks, and from thence to the paper.

2, Lithography, in which the printing plate is a flat surface of stone, zinc or aluminium, part of which is greased to become ink-receptive, the remainder of the plate being rendered ink-repellent.

3, Intaglio printing, where the design is engraved below the surface of the plate. The entire plate is then inked and wiped clean, leaving the ink only in the sunken area from which it is subsequently transferred to the paper. The most widely used process under this heading is known as photogravure; others are die-press, copper, and steel-plate printing.

Petroleum-derived products used in the printing industry can be placed into three categories, *viz.*: printing-ink components, cleaning agents, and lubricants.

Solvents Uses

Volatile solvents are used mainly for photogravure ink, consisting of pigment and a resin dissolved in a volatile solvent; the resin may be natural or synthetic. Asphalts may be used as the resinous component, their dark colour frequently enhancing the colour of the ink.

Oils are mainly used in the manufacture of news inks and magazine inks. They do not dry to a hard film as is the case with linseed oil, but dry by adsorption into the paper rather than by oxidation. Among the attractions of inks made with mineral oils is their low cost, and their suitability for use on inexpensive paper.

Carbon black is regarded as the ideal pigment for printing inks, being completely fast to light, fat, waxes, and many chemicals. It has good tinctorial strength, is not abrasive, and can be purchased inexpensively.

Waxes function as printing ink additives to reduce the length to which a thread of ink may be drawn and to make it less tacky. Petroleum jelly is frequently added to printing inks for the same purpose.

Bitumens are used in photogravure inks as a resin component, and contribute to their colour, particularly in the sepia tone inks used extensively in some illustrated magazines. Bitumens are also used to produce etching resists in the preparation of printing surfaces.

Aromatic extracts are being increasingly utilised for their drying properties, and for partial replacement of linseed oil, rosin or rosin oil. They function as wetting agents and are able to disperse pigments in the ink.

Oil-soluble metal soaps, principally of cobalt, manganese, and lead, find extensive application as driers in printing inks, largely superseding fatty acid soaps such as linolates formerly used for the purpose. More recently, however, salts of naphthenic acid have been found equally advantageous, even scoring over the linolates with their higher metal content. Zinc naphthenate and aluminium naphthenate have limited applications, such as aiding the grinding and dispersion of pigments, and reducing the penetration of the ink vehicle into the paper.

Greases (suspensions of metal soaps, chiefly sodium or calcium soaps in mineral oils) are frequently added to letterpress inks for "shortening" purposes and to reduce excess tack. Greases ought not to be added to lithographic and offset inks because they tend to promote emulsification of the damping solution.

* From a paper by A. C. Healey, Ph.D., M.Sc., F.R.I.C., and L. Ivanovszky, Ph.D. (Fellow) read before the Institute of Petroleum on June 11.

Powell Duffryn Limited

Further Developments

Two developments affecting the future organisation and expansion of their subsidiary companies are announced by the directors of Powell Duffryn, Ltd. Another new company, to be known as Powell Duffryn Carbon Products, Ltd., has been formed to carry on in the Hayes factory the commercial production of carbon products which has previously been conducted in an experimental and development stage at Battersea by Delanium, Ltd., also a subsidiary of Powell Duffryn, Ltd.

A comprehensive research organisation capable of conducting original research and of testing the results on a semi-commercial scale has also been formed to operate in the premises of Delanium, Ltd., at Battersea. The name of Delanium, Ltd., has been changed to Powell Duffryn Research Laboratories, Ltd.

LARGE-SCALE PRODUCTION OF OXYGEN—II*

The Problem of Heat Exchange

by DAVID D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E.

IN the original Linde process tubular heat exchangers were incorporated. These were quite successful but suffered from two disadvantages: first, in involving a fairly heavy pressure drop from top to bottom and, second, in making it necessary to remove from the air feed all moisture and carbon dioxide. Traces of these compounds in the air were deposited as crystals during the cooling of the air stream and led to blocking of the tubes and serious increases in the pressure drop.

The significant advance was the invention in 1930 by Frankl of the exchanger which bears his name and which has played a most important part in the development of the modern large-scale oxygen producing plants. These Frankl exchangers employ the well known principle of exchange of heat between gas streams by the alternate heating and cooling of solids packed in a tower by passage first of one gas and then of another through the packing.

Aluminium Conductors

The towers are filled with porous "pancakes," about 1 in. thick and of such a diameter as to fit closely within the exchanger. To prepare these pancakes corrugated strips of aluminium are employed,

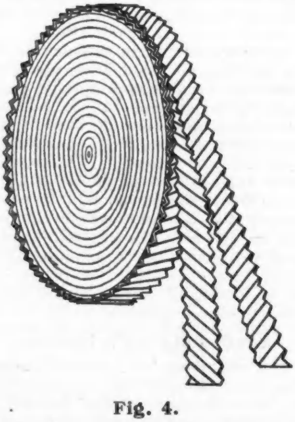

Fig. 4.

the corrugations being arranged at 45 deg. to the centre line of the strip. In preparing the pancake, two strips of aluminium are wound simultaneously, the corrugations in the adjacent strips being set at right angles to one another. In consequence, when the strips are coiled into a circle the strips are held apart at a distance of about ⅛ in. except at the series of points where the ridges of the two sets of corrugations touch one another. After coiling, the strips are held in the form of a pancake by binding with wire. The construction of a "pancake" is shown in Fig. 4.

In packing the exchanger shell a series of "pancakes" is inserted, each unit being laid flat on the unit underneath until the exchanger is filled to the level required. The assembly of these "pancakes" in this way provides an enormous number of small gas channels along the axis of the exchanger, representing a very large area of heat exchange surface. It is estimated that 1 cu. m. of the assembled packing provides 1000 sq. m. of heat exchange surface.

Alternating System

The flow of gases is controlled by regulating equipment at the top of the exchangers, the moving gear being actuated by compressed air. The exchangers operate in pairs, air flowing downward through the first exchanger and becoming cooled during its passage. Separated nitrogen or oxygen from the fractionation tower flows upwards through the second exchanger which is thereby cooled. After a given period the valves are reversed, the ingoing air-stream being cooled by passage through the second exchanger, while the separated gas from the fractionation tower passes to the first exchanger. The reversal of the valves is effected automatically, the time-cycle being adjusted to maintain relatively small temperature fluctuations between the top and bottom of the exchanger.

The important advantage of the Frankl exchangers is that no special apparatus need be provided for the removal of moisture and carbon dioxide from the air feed. In view of the construction of the Frankl exchangers, deposition of ice or carbon dioxide crystals does not affect the operation. Further material deposited during the passage of the air is melted and escapes as vapour during the passage of the stream of gas from the fractionation tower. This fact, however, sets a distinct limit to the purity of the gaseous products obtained as the separated gas is contaminated by the carbon dioxide and moisture originally present in the air intake.

* Part I appeared on June 14.

Weir[5] states that the change from the old type of tubular exchanger to the Frankl type simplifies and cheapens the production of 98 per cent oxygen (the upper limit possible with this arrangement) to an extent not likely to be fully appreciated without detailed study. According to Weir's data, with an air feed at 4.5 atmospheres 0.3 kg. of packing are employed per cu. m. of air feed per hour.

A secondary, but valuable, advantage of the Frankl is the reduced pressure drop from top to bottom as compared with the old tubular exchanger.

American Alternative

Frequently the contamination of the oxygen by the impurities in the air intake by the conditions obtaining in the Frankl exchanger is of no importance. For a number of applications, however, where a high purity product is essential this exchanger is not satisfactory. In this connection considerable importance attaches to the account recently published of the development of a three-channel finned exchanger by S. C. Collins, of the Massachusetts Institute of Technology[6].

In this exchanger the oxygen from the fractionation column is passed continuously down the centre channel, which is surrounded by two annular channels. The nitrogen from the fractionation column and the air intake flow counter-current through the two annular channels. In the one half of the cycle the compressed air, flowing upward in the inner annulus, is cooled by heat transfer to the nitrogen in the outer annulus and to the oxygen in the centre channel. As the temperature of the air falls impurities condense on the walls of the annulus, first liquid water, then ice, and finally (near the cold end) solid carbon dioxide.

After a given period, usually 2 to 4 minutes, the reversing valves operate, the air intake then flowing upward in the outer annulus while the nitrogen from the fractionation column flows downward through the inner annulus. Impurities deposited on the walls of the inner annulus during the first half cycle evaporate into the stream of nitrogen. At the same time condensible impurities are accumulating on the walls of the outer annulus through which the air is flowing.

To facilitate the condensation of impurities and the transfer of heat, it was considered desirable to provide as much surface as possible in the annular channels and to dispose the surface in such a manner that the stream of gas would be spread in thin layers.

The type of heat exchanger chosen is a nested assembly of three tubes with thick annular spaces containing internal fins which are metallically bonded to the walls of the annulus, the new surface produced being two or four times the area of the primary surface. The metallic bond secures the efficient transfer of heat. The principal surface of the fins is parallel to the direction of the gas flow.

A type of finning easy to apply is produced by winding a thin copper ribbon on edge around a slender mandrel. The resulting edge-wound helix is in turn wound on a tube to provide the annular finning, the metal bond being provided by soldering.

Very small oxygen plants—with a capacity of only about 150 cu. ft. per hour—operate successfully for at least 50-hour periods with this design of exchanger. In these plants it is difficult to provide completely efficient insulation and the temperature difference between two streams of gas at the cold end generally exceeds 30°F. Under these conditions carbon dioxide removal is not sufficiently complete. Larger plants—with a capacity of 1100 cu. ft. per hour—employing the same exchangers, but with more efficient insulation, have not shown any signs of inadequate purification. Depending upon the oxygen cycle and the size of the machine, the operating pressure of the compressed air varies from 80 to 175 lb. per sq. in. absolute.

The development of an exchanger of this type offers very attractive possibilities in the production of high purity oxygen on a large scale.

Further information on the reversing exchanger designed by Collins has been given in a very recent paper by Lobo and Skaperdas[13]. These investigators point out that continuous operation of the reversing exchanger was impossible without the use of a small proportion of chemically purified air.

As indicated earlier in this article, chemically purified air from the high-pressure cycle of the Linde-Frankl plants is passed through the exchangers. This permits the complete re-evaporation of ice and carbon dioxide deposited in the exchanger by the low-pressure air intake. The streams of nitrogen and oxygen alone from the fractionation tower are insufficient to evaporate completely the ice and carbon dioxide deposited by the air. Incomplete evaporation of these two constituents on each cycle will obviously lead in a shorter or longer period to fouling of the exchanger until the system becomes inoperable.

Fouling of the Exchangers

As the reversing exchangers under discussion were devised for incorporation in plants in which chemical purification of the air or a high-pressure cycle were not practicable, other means had to be provided to prevent the fouling of the exchangers by unevaporated ice and carbon dioxide. Lobo and Skaperdas point out that the essential condition to prevent accumulation of ice

and carbon dioxide is the maintenance of the temperature of the scavenge nitrogen stream at a critical number of degrees lower than that of the air stream. If the temperature difference between the air and nitrogen is greater than this critical value the nitrogen will be too cold to evaporate all the ice and carbon dioxide.

A simple and ingenious scheme has been devised by Trumpler[14] to provide control of the temperature difference by the adoption of an internal recycle system for the nitrogen. This achieved long-term operation of a reversing exchanger with the complete elimination, for the first time, of chemical air purification.

The arrangement is comparatively simple involving the separation of a portion of the scavenge nitrogen from the main stream flowing to the exchanger. This portion is circulated through a fourth annular space enclosing the exchanger and abstracts heat from the air intake, while the air in turn is further cooled. This recycled nitrogen is then recombined with the main flow of cold nitrogen entering the main passages in the exchanger.

By the adoption of this "unbalance flow" exchanger, oxygen-producing plants have been able to operate for many continuous runs of two to three weeks' duration. No increase in the resistance of the exchanger was noted so long as the "unbalance flow" was maintained in the correct adjustment.

Compression and Expansion Engines

Almost equally important in the development of plants for large-scale production of oxygen was the introduction of the turbine, employed both for compression and expansion. When used as a compressor the turbine is claimed to have a greater efficiency than the reciprocating engine, reducing from 1.7 to 1.3 the factor by which the theoretical power consumption must be multiplied to obtain a value for the size of engine required.

When functioning as an expansion engine the turbine brings the process nearer to the true adiabatic curve and therefore gives rise to a greater refrigerating performance than other types of expansion engines. No oil is required in the turbine so that lubrication difficulties are eliminated.

Turbines may therefore be used to great advantage at low temperatures when severe difficulties are experienced in securing a lubricant which will remain fluid. As will be evident from the description of the Linde-Frankl process given later, over 95 per cent of the total air intake is compressed only to 4.5 atmospheres pressure and within this pressure range the turbo-compressor is almost the ideal machine, being capable of handling large volumes of air at these pressures.

Expansion turbines are also employed in the large-scale Linde-Frankl plants to provide a measure of refrigeration. (Fuller mention of this is made later.)

In the Claude and Heylandt systems for oxygen production reciprocating engines are employed to effect more or less isentropic expansion of compressed air in a cylinder. The main practical difficulty in the adoption of the reciprocating engine is lubrication at the low temperatures obtaining.

In the Heylandt system about 55 per cent of the air is expanded through the expansion engine which is coupled to the compressor to enhance the power available for driving. Recent developments, however, have all accentuated the trend to the adoption of the large capacity turbine for both compression and expansion purposes. New installations are being equipped with turbines.

The Linde-Frankl Process

The Linde-Frankl process, incorporating the Frankl heat exchangers and turbo-compressors and turbo-expanders, represents probably the most efficient plant for large-scale production of oxygen (up to 98 per cent purity) available at present.

The following description of a typical large-scale plant is based on the flow-sheet shown in Fig. 5. Assuming the plant is in temperature equilibrium, the cycle commences with the intake of the total air supply by the turbo-compressor, which boosts the air to 4.6 atmospheres pressure (gauge). Air from the turbine, after passing through the water-cooler, is split into two streams. Up to 95 per cent of the total air stream is fed directly to one of the two pairs of the Frankl exchangers.

During passage through the exchanger the air stream is cooled almost to liquefaction point with the precipitation of any moisture as ice and carbon dioxide as solid crystals. From the exchanger the cooled air stream is fed to the bottom section of the fractionation tower, which operates at about 4.3 to 4.4 atmospheres (gauge).

40 per cent Oxygen

Liquid, containing about 40 per cent of oxygen is drawn off from the base of the fractionation tower, and is subsequently passed through a filter to remove any residual traces of ice or carbon dioxide. The filtered stream of liquid then enters the low-pressure upper part of the fractionation tower at a point where the liquid trickling down also contains about 40 per cent of oxygen. This upper column operates at 0.2 atmospheres pressure (gauge) and, by means of the nitrogen reflux arrangement, separates the feed liquid into almost pure gaseous nitrogen at the top and pure liquid oxygen at the bottom.

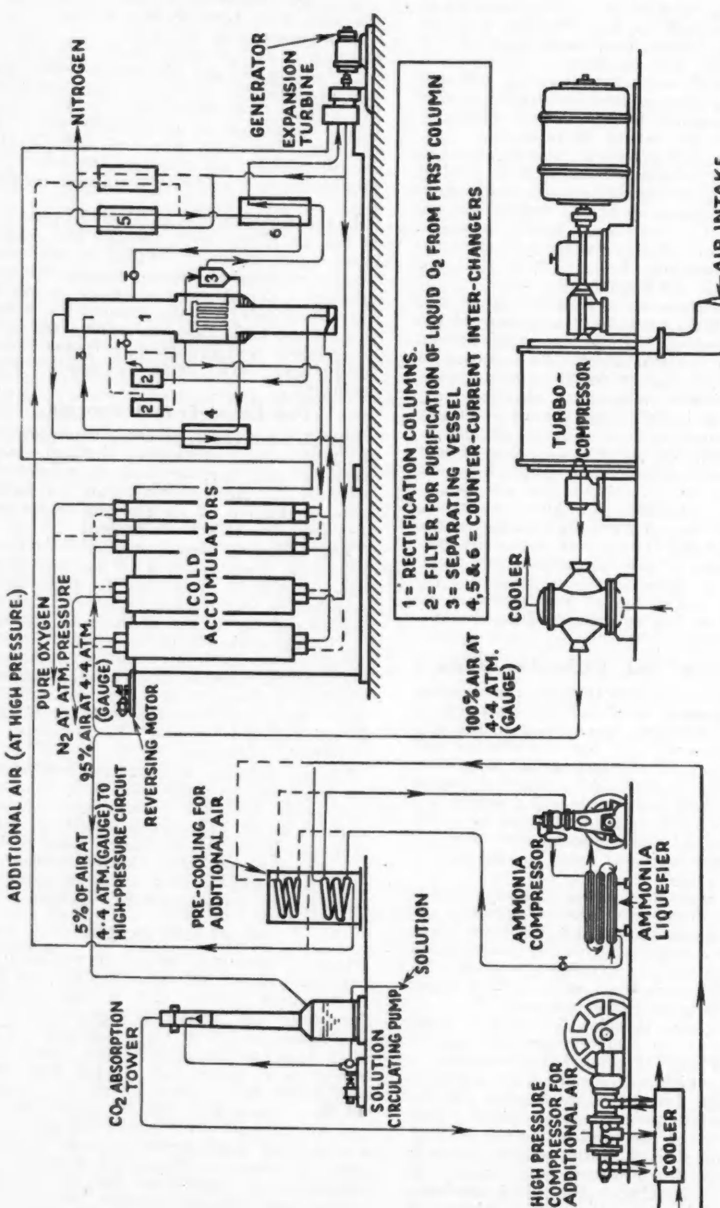

Fig. 5. Linde-Frankl Plant for the Production of Oxygen at 98% Purity.

(C.I.O.S. Report File No. xxvii-55)

As already indicated, the heat for fractionation in the low-pressure upper part of the tower comes from the condensation of gaseous nitrogen rising to the top of the pressure column directly underneath. The tubular condenser-evaporator in the middle of the double tower (Fig. 1) serves two purposes. It supplies the heat for fractionation in the upper column and provides the reflux nitrogen liquid for the lower column, this heat exchange being rendered possible because of the inversion of temperature caused by the difference in the two halves of the column, as described earlier.

Gaseous nitrogen from the top of the column passes through a Frankl exchanger, escaping then either to the atmosphere or to some form of container if the product is to be usefully employed industrially. The temperature in the Frankl exchanger is only 3 to 4°C. below atmospheric.

The boiling liquid, collecting at the base of the upper column is substantially pure oxygen, the vapour from this liquid being deflected through the appropriate Frankl exchanger. From the Frankl exchanger the oxygen emerges as a finished gaseous product of about 98 per cent purity and at a temperature about 3 to 4°C. below atmospheric.

Scavenging and Heating

Each of the streams of separated gases—oxygen and nitrogen—removes by evaporation from the corresponding exchanger the ice and solid carbon dioxide deposited during that part of the cycle in which the air supply was passing through. By passage of the separated gas stream the exchangers are again cooled to the required temperature, the moisture and carbon dioxide escaping with the gases. Evaporation of these solids is sufficiently complete to obviate warming up the exchangers for cleaning, unless at intervals of several months.

This procedure offers many advantages but the purity of the separated gases is affected adversely. For many purposes, however, oxygen of 98 per cent purity is quite satisfactory, the presence of 2 per cent of moisture and carbon dioxide having no importance.

One further operation is necessary in these large-scale Linde-Frankl plants, *viz.*, some method of providing the actual low temperature cooling required to overcome losses and inefficiencies in the various stages of the process. This is provided by high pressure air liquefaction, the flow-sheet for which is shown on the left-hand side of the diagram in Fig. 5.

As explained earlier, some 95 per cent of the total intake of air to the main turbo-compressor passes directly at 4½ atmospheres pressure to the Frankl exchangers. The remaining 5 per cent of the air intake is removed from the main stream by the suction exerted by a small high-pressure compressor.

This suction is sufficiently powerful to draw this by-pass air through an alkali washer which eliminates the greater part of the carbon dioxide and moisture in the stream. The purified air is then compressed to 180 atmospheres. This is followed by cooling, first by cold water to 10°C., and then to −47°C. by contact with liquid ammonia boiling under reduced pressure.

The temperature is then lowered to −70°C. by passage of the high-pressure air through tubular exchangers cooled by the passage of gas withdrawn from the top stage of the double column, at a point where the oxygen content is about 21 per cent. Final cooling to −130°C. is effected in a second tubular exchanger cooled by nitrogen withdrawn from the top of the lower part of the fractionation tower.

This nitrogen, withdrawn in the liquid form, and amounting to some 15 per cent of the total quantity of air being processed, is gasified and slightly super-heated by passage through this tubular exchanger. It is then expanded from 4.5 atmospheres pressure (at which it was withdrawn from the lower column) to 0.2 atmospheres in the small turbine shown at the right-hand of Fig. 5.

The stream from the turbo-expander is split, part passing through an additional tubular exchanger and the remainder joining the main stream from the fractionation tower to the Frankl exchangers.

The stream of high-pressure air, cooled to −130°C. may then enter the main circuit at one of two points. As described by Hochgesand[7] the air is expanded through a valve at a point near the upper column where it liquefies completely. Clark[5], on the other hand, in describing the process employed by I.G. Farbenindustrie at Leuna, gives a circuit in which the stream is expanded through a valve to 4.8 atmospheres pressure into an aperture at the base of the lower column. The resultant temperature is about −177°C. and about 40 per cent of the expanded gas is condensed.

Important Pressure Cycle

Considerable importance attaches to the performance of the high-pressure cycle and to the percentage of the total air intake which must be passed through this cycle. As the external refrigeration is provided mainly by the high-pressure cycle the yield of oxygen is directly connected with the proportion of air passing through this cycle.

At Leuna during 1939 and 1940, when the proportion of high-pressure air was not less than 6.5 per cent of the total, the yield of oxygen was consistently between 87 and 89 per cent. Subsequently, when the proportion of the high-pressure air was limited to

(*Continued on p.* 812)

CANADIAN CHEMICAL INDUSTRY

INCREASING DEPENDENCE ON THE U.S.A.

THE Canadian chemical industry underwent an unprecedented expansion during the war years. Production is expected to stabilise at a much higher level than that attained previously. The wartime demands for explosives and other chemicals necessitated a large increase in productive capacity.

New uses are being found to absorb a great deal of the enlarged plant facilities. Production of chemicals and allied products was valued at $356 million in 1946, a decrease from $462.2 million in 1945 and the all-time record of $730.9 million in 1944, but still over twice the prewar figure of $122 million.

Preliminary statistics for the past year indicate there were 968 plants in operation in this group, employing 36,277 persons, as compared with 808 establishments employing 22,595 persons in 1939. Salaries and wages totalled $72.4 million and materials consumed by the plants were valued at $148.5 million.

War Production

Exports advanced 350 per cent during 1939-45 and imports 75 per cent. Much of this trade was a result of the war, and in 1946 the trend was towards pre-war conditions, with exports and imports well above 1938 levels but under the high wartime peaks. Imports once again were greater than exports. Fertilisers, acids, medicinal preparations, sodium compounds, paints and varnishes and calcium compounds were among the more important items for shipment to other countries.

The records of Canadian imports and exports since 1920 underline the virility of the home chemical industry and the increasing dependence on the U.S.A. Total Canadian imports of chemicals and chemical products in 1920 were worth (in thousands of dollars) 40,010, dropped to 27,653 a year later and had risen in 1946 to 92,874. Receipts from the U.K., 6811 in 1920, were worth only 5739 last year, while the cost of imports from the U.S.A. rose from 31,330 in 1920 (18,327 in 1925) to 83,618 in 1946.

These imports represented a record in 1946 and were more than 200 per cent higher than the pre-war figure of $43.7 million.

Similar increases, especially marked in the war years, are recorded by Canadian chemical exports, which totalled (in thousands of dollars) 21,432 in 1920 and 67,589 in 1946. Exports to the U.K., 4159 in 1920, averaged more than 25,000 annually in the years 1941-45, but fell sharply in 1946 to 3971. Shipments to the U.S.A., which averaged only around 9000 annually up to 1939, rose in the war years to a peak of 51,891 and were 29,998 last year.

The sharp fall in Canadian chemical exports between 1945 and 1946 can be attributed to the halt in the shipment of war materials, of which explosives accounted for a drop of nearly 29,000 and industrial alcohols more than 5000. A rise occurred, however in the largest group of all, fertilisers, exports of which were worth 32,108 in 1946, against 30,428 a year before. The next largest group, general chemicals, other than inorganic, dropped from 15,186 in 1945 to 11,567 last year.

Import returns show an increase in the same category of chemicals from 27,714 to 34,730 between 1945 and 1946. Inorganic chemicals cost Canada 12,563, against 11,270 in 1945, drugs and pharmaceuticals 9370 (9440), cellulose products 6554 (5330) and acids 3228 (3302).

The general conclusion from the figures is that the U.S.A. is Canada's principal customer as well as the main source of her supplies. The chemical industry is important to Canada's economy. In 1939 gross value of products of the chemical industry ranked eighth and represented 5 per cent of the total value of all manufacturing production.

By 1943 the chemical industry had surpassed the non-metallic group in value of output, ranked seventh among manufacturing groups and was the sixth largest employer. Like other manufacturing industries, the chemical industry benefits from the availability of cheap electric power and is the largest purchaser of energy. The electrochemical industry consumed 1,750,413 kWh of electricity in 1943, which was 5 per cent of the total production.

Increased Acid Production

All phases of the industry have experienced growth, and new products, processes and technical improvements have appeared in answer to problems created by the war. The greatest expansion was in heavy chemicals, particularly sulphuric and nitric acids, which were basic to the explosive industry.

Sulphuric acid output nearly trebled between 1939 and 1944 after the plant capacity was doubled and production methods improved. Owing to the tremendous expansion of nitrogen output, the demand for nitric acid and other nitrogen compounds used in explosives was satisfied before the end of the war and the plants were converted to the production of fertilisers, of which there is still a serious shortage.

Among other industrial increases, that of compressed gases was outstanding. Output of acetylene more than doubled and that of oxygen more than trebled. Wartime research

in the plastics industry resulted in the development of new raw materials, new techniques and new products for the peacetime market.

Before the war, the groups with the largest values of output were medicinal preparations and paints, but during the war production of heavy chemicals far exceeded that of the other branches of the industry. All branches, nevertheless, shared in the growth of the industry. In 1946, however, the industry showed signs of returning to the pre-war pattern, the groups with the largest output being: medicinal chemicals, (which include explosives), plastics, insecticides and matches; fertilisers; heavy chemicals; soaps and washing compounds and toilet preparations.

The development of oil refineries and the establishment of the Polymer Corporation Limited, the crown company producing synthetic rubber, at Sarnia, Ontario, forms the nucleus of a rapidly expanding chemical and industrial centre. The Polymer Corporation, which turns out approximately 10 million pounds of buna-S and butyl rubber each month, employs about 1800 people. This plant is unique in that it not only makes both types of synthetic rubber, but it also makes the principal components—butadiene and styrene for making buna-S and isobutylene for making butyl rubber.

The fact that petroleum gases are basic ingredients used in the manufacture of synthetic rubber has had an immediate effect on the expansion of the oil refinery operations in the district. Other industries, dependent on the by-products of the manufacture of synthetic rubber for raw materials, are being attracted to the area.

CANADIAN ACID INDUSTRY

HOW IT WAS BUILT UP

THE history of the development of the acid manufacturing industry in Canada, to which the war added another important chapter, especially in the production of nitric acid, is interestingly reviewed in *Oval*, journal of Canadian Industries, Ltd.

Sulphuric Acid

The first large-scale demand in Canada for sulphuric acid was for refining petroleum at the refineries established at London, Western Ontario, to deal with the newly located oil supplies. The acid had at first to be brought by sailing vessels across Lake Erie from Cleveland, and in the 60's of last century the Canada Chemical Company started making the acid on the spot with a chamber process plant at London.

About ten years later a plant at Brockville, Ontario, was producing sulphuric acid from local pyrites or iron sulphide, of which Canada has widespread resources. Another innovation at the same plant was the manufacture of superphosphate from acid and local phosphatic rock.

Nobel's invention of dynamite in 1867 gave fresh stimulus to the use of acids in Canada and the new explosive in turn helped the raising of sulphide ores whose fumes during smelting provided another source of acid. This was first practised in the province of Quebec in the '80s.

The smelting of local copper ore at Capelton, Quebec, led to the production in 1887 of sulphuric acid by chamber process using relatively very advanced plant, including platinum stills for producing 98 per cent acid. Nitric was also made here, using sulphuric acid and Chile saltpetre. The oldest chamber plant still operating in Canada was established at Sydney, Nova Scotia in 1901. Its acid is largely used to produce ammonium sulphate fertiliser from ammonia derived from the coking process in steel manufacture.

At about the same time was introduced in Canada the contact acid process, using the catalytic properties of platinum, which had been pioneered in England 60 years before. It was first used at Sulphide, Ontario, and later was adopted in British Columbia and Hamilton.

A notable advance later was the construction at Coniston, Ontario, of a contact unit pioneering the conversion for sulphuric acid of fumes from Bessemer converters operating on copper-nickel ore. The lead was quickly followed at the International Nickel Company's smelter at Copper Cliff, Ontario, and at Trail, British Columbia where zinc smelter gas was the source.

Nitric Acid Production

An important departure in nitric acid production, then employing the reaction of sulphuric acid with Chile nitrate, was the introduction in 1930 of the "air and water" principle by the oxidation of ammonia, made from alkali at Windsor, by a new process. During the war plants to make ammonia and nitric acid were set up at Port Robinson, Ontario; Calgary, Alberta and Trail.

Hydrochloric acid ("muriatic") has been produced in Canada since 1903 and is finding a new use in the manufacture of vinyl plastics; and phosphoric acid, used in fertilisers and detergents, is an important product of Buckingham, Ontario.

South African Chemical Notes

(From our Cape Town Correspondent)

STEPS have been and are being taken to get larger supplies of fats and oils for the Union, and the allocation of fats and oils to manufacturers and others is being reviewed to see whether a larger quantity can be made available for soap making. This information was given in the House of Assembly by the Minister of Finance. He said soap manufacturers had indicated that the production of soap in the next few months would be 50 per cent higher than for January and February this year. How long the increased production could be maintained depended on oil supplies. Importers had recently been able to get soap from the United States and from certain countries in the British Commonwealth.

* * *

A small consignment of linseed oil from Uruguay, the first to reach the Union since June, 1946, will cost the public about 21s. a gallon, said the chairman of the South African Paint Manufacturers' Association. The price of linseed oil before the war was 2s. 3d. a gallon. He said that another small consignment from the Argentine would probably cost about the same and it was inevitable that the retail price of paint would be increased. He added that the biggest problem facing the South African paint trade today was the supply of containers. The quantity of tins and drums available today was less than half that a year ago, and the position was worse than at any time during the war.

* * *

Producers of palm oil in the Belgian Congo are petitioning the Brussels Government to alter the present marketing arrangements so as to enable them to export to the natural Congo markets—South Africa and the Rhodesias. At present all the Congo production, about 100,000 tons, has to be delivered to Belgium at £50 a ton, whereas the price in the world market is £80 a ton. In this petition the producers express their willingness to deliver to Belgium a sufficient quantity for her metropolitan needs.

* * *

The Companhia Nacional de Cimentos has been authorised by the Portuguese Government to erect a cement factory in the province of Manica and Sofala. Negotiations have been started with the Beira Railway Company for the sale of a plot of land along the railway line, and for siding facilities to be provided. This will be the first cement factory in this part of East Africa, and it is expected to bring about a considerable reduction in building costs in the area.

African Explosives and Chemical Industries are building a plant at Klipspruit near Johannesburg for the production of cyanide for use in the gold mining industry, from methane gas supplied by the Johannesburg municipality. Most of the drawings for this factory have been completed. It is hoped to begin manufacture next March.

In addition it has been found necessary to carry out various extensions to the Modderfontein plants, mainly in the ammonia and nitric acid units. A committee was appointed to deal with the proposal to build an additional ammonia plant capable of supplying all the nitrogenous fertiliser requirements of Southern Africa. The committee recommended that an additional ammonia plant with a capacity of 25,000 tons per annum should be established at Modderfontein together with the ancillary plant needed to turn the ammonia into products suitable for issue to farmers.

Another development to which consideration is being given is the local manufacture of high-grade salt. It is hoped that during 1948 it will be possible to undertake work to stabilise the price of salt at a reasonable figure. Consideration will also be given to the manufacture of purer grades of salt for human consumption. It has been decided to manufacture at Modderfontein the aluminium detonator tubes formerly imported for filling locally. The products will include all types of detonator tubes and the small amount of copper detonator tubes for use in the coal mines. The company is also considering producing litharge of suitable grade for assay purposes in the gold mines and has developed a method of producing this grade of litharge from lead supplied by Rhodesian interests.

* * *

The South African Goodwill Trade Mission which recently visited the East African territories has issued a report dealing with export commodities from the Union, and it says that among the commodities which came in for particularly high praise were paint and at least one brand of boot polish. South African paints were highly recommended but cheaper grades were required in smaller packs for the Africans. Insecticides from the Union were also in very good demand.

Sports Tournament.—On Saturday, June 14, Messrs. Johnson Matthey and Co. Ltd. held a sports meeting at the company's ground at Dulwich, S.E. Among the interesting list of events, for which all branches competed, were five-a-side football and netball tournaments, and ankle and men's legs competitions.

Chemical Hazards in the Electrical Industry*

by C. B. FAGAN, B.Sc., F.R.I.C.

WHILE at first sight it might not appear that electrical industry presents any real type of chemical hazard, it must be remembered that the industry exhibits a great diversity, and many electrical firms carry out a number of processes which are essentially chemical in nature.

In a certain electrical firm, where a number of specialised chemical processes are used, hazards arise in connection with the cutting and etching of quartz, electroplating involving the use of cyanide solutions, paints and varnishes (including the use of solvents for degreasing), etc. The chemist may be called upon to assess such hazards and to advise managements as to the safeguards that should be introduced.

Hydrofluoric Acid Risks

Hydrofluoric acid is used to a considerable extent in quartz crystal manufacture as an etching agent. Most accidents occurring during the use of this acid are due to burns, but the vapour danger cannot be disregarded. It has been known for some time that burns from hydrofluoric acid differ to a considerable extent from other acid burns, inasmuch as the acid causes a horny layer of skin to be formed, under which the acid is still active.

Etching of quartz is carried out in large flat guttapercha trays, and when the acid is fairly concentrated there is danger from fumes. To detect this a zirconium lake of sodium alizarin sulphonate may be dried on sintered glass tubes or absorbent papers, which are placed in various parts of the room. There is a definite colour change when the concentration of hydrofluoric acid reaches a dangerous figure.

Cyanide Plating Solutions

An obvious hazard with plating solutions is that due to cyanide. With silver-plating baths there is some vapour hazard from hydrocyanic acid, when excessive current densities are used. Cyanide copper-plating baths, when used hot, often cause bleeding of the nose—due to fumes. For this reason it is advisable to fix exhaust cowls over this type of bath. Hazards from nickel baths are mainly due to splashing, which, on unprotected skin, often gives rise to an affection known as "nickel itch." Hazards from chromium plating are mainly due to the fine spray of chromic acid solution given off. The effect of this spray on the eyes is very severe, and it has been known to destroy the septum of the nose. Chromic acid is used a considerable extent in the passivation of zinc.

The danger of accidental poisoning due to swallowing cyanide solutions may be minimised by providing "cyanide antidote" ready for use in a prominent part of the shop. The antidote usually consists of solutions of iron sulphate and sodium carbonate which are mixed immediately before use.

One source of hazard is the consumption of food in shops or departments where poisons are used or stored. While the Factory Act, 1937, prohibits the taking of meals in certain places where chemical processes are used, the ruling only applies to the main mid-day break. During the morning and afternoon "tea-break" the consumption of food is not prohibited and it is left more or less to the employee's discretion. While this rule has obviously been adopted to save time, there can be little doubt that it establishes a dangerous precedent.

Methyl silicon chloride (CH_3SiCl_3—used in imparting tropical finishes) requires special mention. This substance is used to give water-repellent properties to ceramics, etc. The substance itself is a fuming liquid of low boiling-point which is applied to the ceramic surface by brushing or dipping. The hazards from methyl silicon chloride are due to inhalation of the vapour, which may cause the lungs and air passages to be coated with water-repellent films and lead to asphyxiation. Here, too, adequate protection by draught is necessary.

Potential Explosives

An unusual substance used in valve manufacture is barium azide (BaN_6), which is useful because, when heated *in vacuo* it decomposed quickly, nitrogen being liberated and barium metal obtained. The compound is spontaneously explosive under certain conditions and on no account must large crystals be allowed to form in stored bottles of a saturated solution; lead drains or ducts must not be installed where barium azide is used because of the danger of forming explosive lead azide. Acids must be kept far away from azide solutions because of the danger of forming explosive hydrazoic acid. When used intelligently, however, there is little hazard from barium azide, which is one of the least explosive azides of the heavier metals.

* **Extracts from a lecture given before the Sheffield, South Yorks and North Midlands Section of the Royal Institute of Chemistry.**

German Chemists Indicted

A DOCUMENT of some 90 pages has now been produced containing the indictment as war criminals of the 24 officials of I.G. Farbenindustrie, the great German chemical and industrial group. Among the principals indicted are Max Brueggermann, Heinrich Hoerlein and William Rudolf Mann. Hoerlein is stated to have been chief of chemical research and development of vaccines, sera, pharmaceuticals and poison gas, among other things. Mann and Brueggermann are stated to have been prominently identified with the pharmaceuticals combine.

The indictment is divided into five counts: (1) Planning, preparation, initiation and waging of wars of aggression and invasions of other countries; (2) plunder and spoilation; (3) slavery and mass murder; (4) membership of the S.S., and (5) common plan or conspiracy.

Germany's Industrial Future

RETURNING German heavy industries to politically undesirable former owners is to be avoided; to vest ownership in the German State might forge a powerful weapon of centralised control which might increase Germany's potential danger to world security. This is one of the problems recognised by the international committee set up with the support of the International Chamber of Commerce to study the economic effects in the international sphere of the post-war situation in Germany. The committee's report, published in the I.C.C. journal *World Trade,* recommends a return of the heavy industries to private ownership and a retention of an over-riding control by Allied holdings of capital in the German credit agency.

Next Week's Events

TUESDAY, JUNE 24.

British Ceramic Society (Refractory materials section). Spa Hotel, Buxton, 5.30 p.m. General Meeting. J. H. Chesters, T. W. Howie and T. R. Lynam: "The Development of Basic Insulating Bricks."

WEDNESDAY, JUNE 25.

Institute of Welding. Institution of Civil Engineers, Great George Street, S.W.1, 6 p.m. Annual general meeting.

THURSDAY, JUNE 26.

Mineralogical Society. Burlington House, Piccadilly, W.1, 5 p.m. Scientific Papers.

Salt Difficulties

IT is reported that owing to a ban on the transport of home-produced road salt, local authorities are having to obtain the imported product, and are consequently having to pay more than double the accustomed price. A Ministry of Food official, commenting on this report, remarked to our representative that there is no ban on the transport of home-produced salt, but where difficulties have arisen, the Ministry is doing everything possible to assist. Salt imports, the official continued, are solely for fishery purposes as our own supplies are inadequate at the height of the fishing season. Curiously enough, a spokesman of one borough council stated confidently that its "usual supplier at Northwich" was rendered impotent by the ban. The salt which the council was able to obtain came from Italy and was not apparently of the variety normally used for fish preserving.

Ten workmen at the Clydebridge steelworks, Cambuslang, were admitted to the Royal Infirmary, Glasgow, on June 13, suffering from coal gas poisoning. The men, general labourers, were working in a melting shop where other employees were cleaning producer gas mains when a leak developed in one of the blast-furnace valves. One by one they began to complain of feeling unwell, and they were assisted out to the fresh air, when first-aid was administered by the works ambulance men. The workmen were unaware that the odourless and colourless gas was having any effect on them. Some of them collapsed.

Obituary

MR. GEO. NEWBERY, B.Sc., F.R.I.C., died on June 14, aged 53 years.

MR. A. F. LAWSON, a director of Jenson, Lawson and Co., Ltd., S.W.1, died on Sunday, June 8.

MR. A. L. RECKITT has died at Bedford Square, London, W.C., aged 70. Chairman of Reckitt & Colman, Ltd., he was a grandson of Mr. Isaac Reckitt, the founder of Reckitt & Sons. He was connected with the company for nearly 50 years, becoming a director in 1904.

DR. GLEN MILLER SMYTH, technical consultant for the Calco Chemical Division of the American Cyanamid Company, Bound Brook, New Jersey, has died at the age of 57, at Plainfield, New Jersey. He assisted in founding the Beaver Chemical Corporation in 1918 and was resident director until 1930, when the corporation was absorbed by the Calco Chemical Co.

INDUSTRIAL REPORT FROM ITALY

From our Rome Correspondent

THE paint and varnish industry is not so favourably placed in Italy as some other chemical industries because the raw materials it needs are costly and most are imported. Paint is therefore not exported, even though good markets may be found in several Mediterranean countries.

Nevertheless, it is an industry with a future as its rapid pre-war development shows. A quarter of a century ago there were but half a dozen paint and varnish manufacturers in the country, while to-day there are about a hundred in Lombardy alone and about fifty more located in various (mostly northern) parts of Italy.

At present the joint output of these manufacturers roughly suffices to fulfil the needs of the country and adequate quantities of pigments, minium, oxides of iron, zinc white, lead carbonate and oxide of titanium are produced. Generally speaking, the absence of Germany as a supplier in this field is not felt.

Like most other industries in Italy the production of paints and varnishes is hampered by lack of raw materials, and the position would have been still worse had not Italian chemists been able to overcome the shortage of linseed oil. Chemistry is one field in which Italians have shown some skill and imagination, as is evidenced by the success which has attended their efforts in producing substitute materials. Much research work has been carried out for example in the laboratories of Montecatini at Cesano Materno near Milan which, compare favourably with other countries.

The problem of linseed oil was solved by replacing this product by oil extracted from raisin stones. Italy's output of linseed oil cannot satisfy even 10 per cent of the needs of the paint and varnish industry, and during recent years even less has been available. Raisin stones, on the other hand, are available in large quantities and the oil extracted from them is suitable for many purposes either pure or mixed with glycerine or other substances. Furthermore, there is a tendency for Italian manufacturers to replace enamels based on fats with synthetic enamels derived from glycerophthalic resins which appear to last longer particularly when applied to surfaces subject to blows, scratching and erosion.

A range of other resins based on colophony has been marketed to replace several products of tropical countries. On the other hand, the problem of obtaining adequate supplies of colophony has not been solved, and Italy has to import large quantities from France, Greece, Spain and elsewhere. Attempts have been made to exploit the pine forests of the country, and although half a dozen experimental plants recently sprang up for the purpose, home-produced colophony has not yet acquired any importance. Another stumbling block is the output of phthalic anhydride which, owing to the shortage of electric power, has fallen during the recent months. There is no lack of turpentine and methylic and ethylic spirits.

On the other hand there is a shortage of nitrocellulose solvents, butylic spirit and acetone. Italy used to produce sufficient quantities of nitrocellulose solvents for her own needs, but output is now being hampered by shortage of raw materials. Acetone production is considerably reduced by lack of calcium carbide from which it is derived synthetically and which it has not been possible to produce on a sufficient scale owing to the shortage of electric power. The situation with aniline and organic pigments is reasonably good.

It is reported that 4000 tons of copper have arrived for the production of copper sulphate of which 80,000 tons will probably be produced this year. This will be an improvement over last year and will largely fulfil the needs of Italian agriculture.

The output of mercury which in 1946 reached 83 per cent of the pre-war figure, headed the list of industrial products. Iron and aluminium ore output, on the other hand, amounted only to 12 and 11 per cent respectively.

SCOTTISH EXHIBITION PLANS

MANUFACTURERS, it is anticipated, will find in the forthcoming "Enterprise Scotland" Exhibition encouragement to locate new factories in Scotland, where there is still a substantial pool of labour available and other advantages, such as the prospective hydro-electrification systems. This was one of the points made by Sir Stafford Cripps, describing at a Press conference in London last week the plans made by the Scottish Committee of Industrial Design to utilise 30,000 sq. ft. of floor-space at the Royal Scottish Museum, Edinburgh, during August 25-September 30, where nearly 1000 firms will contribute to the survey of Scottish products and services. Sir Stafford indicated that very complete arrangements would be made to facilitate buyers' activities, by provision of a buyers' room, interpreters, means of putting them in immediate contact with specialised manufacturers and providing them with full export information.

(Continued from p. 805)

6 per cent by shortage of compressors the yield of oxygen fell to 85 per cent.

Clark[5] states that the power consumed by the turbo-compressors at Leuna was 92.5 kWh per 1000 cu. m. of low-pressure air intake. On the basis of an 88 per cent yield of oxygen and with 6.5 per cent of the total air passing through the high-pressure cycle, this amounts to a power consumption of 0.47 kWh per cu. m. of 100 per cent oxygen.

As the records show a total power consumption of 0.59 kWh per cu. m. of 100 per cent oxygen, it is obvious that 80 per cent of the total power consumption is expended in the initial compression of the air intake to 4.5 atmospheres pressure. With a power consumption of only 0.12 kWh per cu. m. in the high-pressure cycle it is evident that a comparatively small proportion of the total energy is required to provide the cooling effect in a well-designed air-separation process.

(To be continued)

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Chemicals in Water Purification

Many chemicals, some in large quantities, are used by the various water companies to purify drinking water. In the London area the Metropolitan Water Board uses over 500 tons of chlorine for purification purposes, as well as many other chemicals including ammonia and the well-known acids. Numerous laboratory tests, both for bacterial and chemical content of the water are carried out. Shown below is an M.W.B. laboratory equipped for estimating the ammonia content of the water. Another interesting test is that of checking the amount of chlorine in the water by ortho-tolidine.

A laboratory for the ammonia test.

LETTERS TO THE EDITOR

Unloading Chemicals

Dear Sir,—In your issue of June 7 you published a letter under the heading "Unloading Chemicals," showing a vessel loaded with sulphate of ammonia being discharged at our works. Your correspondent states that the reason grab discharge was discontinued was owing to the attack on the metal of the grabs by the sulphate of ammonia, but this was not the reason for the change to bucket discharge.

For four or five years sulphate of ammonia has been discharged at this works by means of grabs, but a certain amount of spillage of the material was unavoidable, and it was discovered recently that the sulphate of ammonia had attacked the concrete of the quay to a considerable extent, with the result that the Ipswich Dock Commission refused to discharge by grab any longer.

Your correspondent's suggestion therefore, that a concrete bucket would get over the difficulty, is beside the point as the wear and tear on the grabs was not excessive.—Yours faithfully,

For Fisons, Ltd.,
Walter G. T. Packard,
Vice-chairman.

Harvest House,
Ipswich.

German Fertilisers

Dear Sir,—In No. 1455 (May 31, 1947, pp. 711) of your journal we find a note about "German Synthetic Fertilisers," in which it is stated that according to the United States Office of Technical Service, the I.G. Farben at the Leuna and Piesterit plants, had developed a new process for the manufacture of synthetic fertilisers without the use of phosphoric acid.

We wish to state that according to the description given, the method represents inventions made here by our chemical engineer, Mr. E. Johnson, and which have been licensed to I.G. Farben. This will also be seen from the final FIAT report No. 718, authors of which are the American civil engineers Robert McCullin with B. H. Wilcoxon and Alexander Bogrov. On p. 14 in this report it is stated that "the process was in reality based on a Norwegian owned patent, issued to Odda Smelteverk A/S, to which I.G. Farben has a licence." The process is duly covered by patents in all greater countries.

In the FIAT report there is further given the following statement regarding the process: "The Leuna management felt that the new process has distinct advantages over the old and should, therefore, be of considerable interest to the U.S."

The principal idea of the process is that rock phosphate is treated with appropriate amounts nitric acid of special suitable concentration. By cooling to room temperature or somewhat lower, nitrate of lime is crystallised out and further transformed to nitrate in the usual pellet form with 15.5 per cent nitrogen content on the one side. A solution of strong phosphoric acid is left with a small amount of nitrate of lime and a small excess of nitric acid. This mother liquor is transformed to complete concentrated fertilisers in granular form by neutralising with ammonia and adding potassium salts.

It will be seen that no "outside" chemical product and power is consumed by the process. Thus the nitric acid is a substitute for sulphuric acid, but does not add to the cost as it retains its full value as fertilisers in the outgoing products, in contrast to the gypsum precipitate when using sulphuric acid. The blast or electric furnace process for producing phosphoric acid has the extra consumption of coke and quartz with greater amounts of slag products to dispose of; in the latter case also there is consumption of larger amounts of electrical power.—Yours faithfully,

ppa Odda Smelteverke A/S.

Odda.

Lack of Steel Workers

Mr. William Leonard, M.P., Parliamentary Secretary to the Ministry of Supply, making a speech at the commencement of his tour of Scottish industries last week, said that the variety of inducements offered by firms in England to skilled moulders in Scotland, reflected the man-power difficulties in the iron and steel industry. In their anxiety to recruit labour, English firms, he said, were advertising extensively in the Scottish press. Among the inducements offered were piecework schemes, "continuous employment for many years," and "good lodgings found." This had resulted in a slight drift South, but it could not be called a substantial movement.

When he visited the works of Messrs. Babcock and Wilcox, Renfrew, the difficulties of maintaining the firm's production programme were brought to Mr. Leonard's notice by the Joint Production Committee. Shortages of steel, scrap, and pig iron, tubes, and labour were pointed out to him by Mr. J. W. Hargreaves, managing director, who emphasised that the firm manufactured all boiler equipment for electrical power stations. Mr. Leonard agreed that the position was difficult, and said that the Heavy Electrical Plant Committee held monthly meetings in London to consider those shortages.

PARLIAMENTARY TOPICS

MORE SHORTAGES REVEALED BY QUESTIONS

Government Acquires Thorium, Ltd.—Major D. W. T. Bruce asked the Minister of Supply whether he would make a statement concerning the Government's acquisition of the business of Messrs. Thorium, Ltd.; whether he would publish the terms, and whether he would state the annual amount of the management fee with details of the managerial functions performed?

Mr. Wilmot: The business and premises of Thorium, Ltd., of Amersham, have been acquired on the basis of agreed valuations of the freehold property, equipment, stock-in-trade, and goodwill. The company is responsible as my agent under my direction for running the radio chemical centre for the processing, packing, and distributing of natural and artificial radio-active substances required for medical-scientific and industrial purposes. It would be contrary to the usual practice to disclose the terms of the acquisition or the management fee.

Atomic Energy Prospects.—"It is too early to make any reliable forecast," said the Minister of Supply (Mr. J. Wilmot) when he was asked by Major W. F. Vernon, when he expected the first atomic energy plant for industrial purposes to be in production, and if he would publish data on which a provisional assessment of the prospects of atomic power for industry could be based.

Coal May Cost £8 Ton.—The U.K. is to receive 600,000 tons of American coal in the third quarter of 1947, provided American coal production permits the export of not less than 3 million tons a month. Giving this information in reply to a question by Col. Lipton, the Fuel Minister added that allocations for the fourth quarter would not be made before August and could not be forecast now. In a written reply to Mr. A. C. Bossom, he said no contracts for American coal had yet been concluded and estimates ranging from £5 to £8 a ton had been mentioned.

Plaster of Paris Needed.—Asked by Mr. Philips Price if the Minister of Works was aware that there was a serious shortage of plaster of paris required for making laboratory porcelain, Mr. C. W. Key said the department was not aware of such a shortage. No plaster of paris was being exported from this country to Germany under the auspices of the Ministry. If Mr. Price had any particular case in mind and would send particulars he would be glad to look into the matter.

Burned Lime Shortage.—Maldistribution of lime and of coal for its production was alleged in questions by Mr. Ellis Smith, who wanted to know why approval had been given to allocations of coal which resulted in uneconomical methods in steel furnaces; why unburned lime, requiring more coal and pig-iron, was used; and if the Minister was aware that 300 tons of slack would enable 1000 tons of burned lime to be produced, which would facilitate the output of 25 per cent more steel.—Mr. Wilmot: During recent months cases have occurred in which steel makers have had to use unburned lime, but I am assured that over the industry as a whole the effect on the total output has been small. The revised coal allocations to lime producers for the summer months should ease the position substantially.

No Dutch Linseed.—The Food Minister (Mr. J. Strachey), replying to Col. J. R. H. Hutchinson, said that reports that Holland had a surplus of linseed were unfounded. Attempts by the Ministry to buy linseed for sowing had revealed that Holland was herself short of linseed. Many competitors, he said, considered the British bulk purchasing commission had purchased a very much larger share of available linseed at a very favourable price.

More Steel Wanted.—The occupation of two large factories in the South Wales Development Area is delayed because of shortage of steel, and several firms have withdrawn applications for new factory space because steel supplies are inadequate. . . . I regret that the present steel supply difficulties will preclude any immediate improvement in the situation.—Mr. J. Belcher.

Review of Patents Law.—Mr. S. Hastings asked the Prime Minister whether he will consider the provision of an office to which persons can submit inventions, ideas and suggestions which they are desirous should be used for the benefit of their country rather than for themselves, so that these might be critically examined in that office and only referred to a Department of State should they seem promising. The Prime Minister: The whole field of patent law and inventions is being reviewed by the Departments concerned, and my hon. friend's suggestion will be borne in mind.

German Chemical Industry.—Mr. G. R. Chetwynd asked the Minister of Supply if he has considered the B.I.O.S. Final Report, No. 1007, Instrumentation and Control in the German Chemical Industry; and what action he proposes taking to implement the recommendations of this report.—Mr. J. Wilmot: Yes, Sir. The recommendations are now being examined in detail with the industry.

Home News Items

More Dunlop Workers.—Between August and the end of the year the Dunlop Rubber Company hope to employ another thousand workers at their Speke factory. This will bring the number of people working there to more than 6000.

Hotplate Control.—Messrs. Sunvic Controls, Ltd., point out that the "Simerstat" electric thermostatic control is made by their company.

Scottish Steel Plans.—A long-term policy for integration of the Scottish steel industry and immediate action to modernise and increase the output of existing plants were discussed in Glasgow last week at a conference between the Iron and Steel Board and representatives of the Scottish Labour Party and the Scottish T.U.C.

Gas Engineers Meeting.—The 84th annual general meeting of the Institution of Gas Engineers, held last week under the presidency of Mr. George C. Pearson, O.B.E., was attended by more than 1200 gas engineers from all parts of the world. Following the presidential address, six papers were presented and discussed.

Voluntary Award.—An *ex gratia* payment by John Lysaght, Ltd., of £550 to the widow of an employee killed in the company's Scunthorpe steelworks was approved at Lincolnshire Assizes last week. The accident, it was stated, was caused by the employee disregarding orders. He had served 25 years with the firm. Judgment was entered for John Lysaght, Ltd.

Miners Seek More Concessions.—New demands are being made in various areas by the National Union of Mineworkers. The Midlands area is seeking the payment of full rates to miners of 18, the Scottish area wants free transport for all miners who travel more than three miles to their work, and the Yorkshire districts require pensions at 55 for miners who cannot work and at 60 for all others.

Dunlop's Making Chemical Linings.—A large one-floor factory, adjacent to the Dunlop Rubber Company's Manchester works has been acquired by the company to cope with the increasingly heavy demand for roller covering and chemical plant lining of rubber and probably of plastics. Production has already started, and the whole manufacturing lay-out is quickly reaching completion, Sir George Beharrell told Dunlop shareholders last week. The new building has enabled the company to undertake very large orders for important components required in the production of chemical plant.

Tinplate Stolen.—Following reports last week that eight tons of tinplate had been stolen, police from three counties chased a "mechanical horse" for more than 60 miles. Two men were later detained near Pinewood film studios.

Liquid Helium Conference.—A conference on liquid helium is to be held at the Clarendon Laboratory, Oxford, on June 27 and 28. Further particulars may be obtained from Professor F. E. Simon, Clarendon Laboratory, Parks Road, Oxford.

Workmen Shareholders.—Two hundred veteran employees of the Avon India Rubber Company are each to receive the income from 50 shares in the company they helped to establish, based on a gift of 10,000 ordinary shares given by the chairman of the company, Major Robert Fuller.

Reinstatement Ruling. — The Central Reinstatement Committee in Glasgow has decided not to recommend that compensation shall be paid to returning ex-Service men who before enlistment were employed by the Government-owned factories operated by private firms on Ministry of Supply contracts.

National Physical Laboratory Exhibition.—An exhibition of scientific work and apparatus was held at the National Physical Laboratory from June 18-20. Of particular interest was the testing and etching of volumetric glassware in the physics section, and microchemical methods of analysis, and unusual metals in the metallurgical section.

British Instruments Pre-eminent.—Nothing was more important in the whole range of British production than scientific instruments, said the Minister of Supply (Mr. John Wilmot) opening the exhibition of scientific instruments in London last week. There was, he said, every indication that the mounting exports of scientific instruments would be maintained. Britain led the world in the manufacture of these instruments.

Coal for Steel.—More coal is being rushed to iron and steel plants in Glasgow and Lanarkshire this week-end, following representations by the Iron and Steel Trades Confederation. It is understood that full production should be possible at every establishment by June 16. Scotland is producing about 460,000 tons of coal per week, of which 25,000 tons is needed weekly for iron and steel. If this amount is forthcoming the industry will be able to keep shipbuilding and other iron and steel consumers going at full speed.

Chemists Honoured

People well known in the chemical industry figure in last week's Birthday Honours List.

DR. ANDREW M'CANCE, who receives a knighthood, is deputy chairman and joint managing director of Messrs. Colvilles, Ltd. He is one of the foremost metallurgists in Britain and for many years has had an international reputation. His contributions to the technical development of the industry have been notable.

MR. ANDREW SIMPSON MACHARG, senior partner of McClelland Ker and Co., Glasgow, who also receives a knighthood, is chairman of Messrs. A. and J. Main and Co., Ltd., Clydesdale Ironworks, Glasgow.

MR. J. E. C. BAILEY, managing director, Baird and Tatlock, Ltd., receives the C.B.E.

MR. H. HALLIDAY, director of the National Federation of Clay Industries, gets the O.B.E.

The M.B.E. is conferred on:—

MR. R. S. BROWN, chief metallurgist, Ryland Bros., Ltd.

MR. M. W. BURT, manager and secretary, Society of British Gas Industries.

DR. E. H. T. HOBLYN, secretary, British Chemical Plant Manufacturers' Association.

MISS H. M. MCKENZIE, research chemist, Alex. Pirie & Sons, Ltd.

MR. D. NYE, manager, White's Cement Works.

SIR HARRY HARRISON BURN, of Imperial Chemical Industries, Calcutta, receives the K.B.E.

Personal

MR. L. P. O'BRIEN, chairman of B. Laporte, Ltd., of Luton, has been elected a director of the Fullers' Earth Union.

MR. NEIL HERON, deputy public analyst of Portsmouth, has been appointed deputy analyst at Liverpool.

MR. J. P. LEWIS has been appointed by Messrs. Edgar Allen & Co., Ltd., to an executive post at the Imperial Steel Works, Sheffield.

DR. K. B. WILSON and MR. C. J. H. TASKER, both of the research department, Imperial Chemical Industries, dyestuffs division, have been awarded the Moulton Medal of the Institution of Chemical Engineers, for their paper on the design of tubular reactors used in the manufacture of phthalic anhydride.

LIEUT.-COLONEL S. C. GUILLAN, T.D., has been appointed secretary of the Institute of Metals and editor of its publications. He will take up his dutes with effect from July 1, 1947.

DR. C. E. K. MEES, F.R.S., vice-president and director of research of the Eastman Kodak Co. of America, who is now in Europe, will shortly give several lectures in this country on the subject of research organisation.

MR. ROGER M. LEE succeeds his father, Mr. Lennox B. Lee, as chairman of the Calico Printers' Association, Ltd., at the end of this month. He joined the company from Cambridge in 1923. Mr. Lennox Lee, who has held the chairmanship for 39 years, retains his seat on the board.

DR. G. E. GARDAM, a metallurgical chemist specialising in metal finishing and electroplating, has been appointed Director

Dr. G. E. Gardam.

of Research to the newly-created Design and Research Centre for the gold, silver and jewellery industries.

ALDERMAN W. BURROWS, of St. Helens, was reappointed chairman for the ensuing year at a meeting of the joint committee of chairmen and gas engineers of the fifteen voluntary undertakings in South-West Lancashire, held in Warrington on June 12.

The following staff changes have been made by the British Aluminium Co., Ltd.: MR. FREEMAN HORN, on reaching the retiring age at the end of June, is relinquishing his position as intelligence officer and manager of the special products department. He is being retained in a consultative capacity to the company until the end of 1947. MR. L. V. CHILTON, M.A. (Cantab.), has been appointed manager of the Intelligence Department, and MISS W. LEWIS, B.Sc., information officer.

Overseas News Items

Aromatics from Petroleum.—Benzene made from petroleum by the Shell company will soon be offered to the U.S. chemical market.

Swedes Buy Argentine Linseed Oil.—According to reports from Buenos Aires, Sweden has bought 4000 tons of linseed oil at 223 pesos per quintal (of 100 kg.) as well as 12,000 tons of linseed by-products. Newsprint is to be supplied in return.

Bauxite From Hungary.—Italy is buying 5000 tons of bauxite from the Hungarian Bakonyi Bauxit Company at 75.53 dollars a ton. In compensation the firm is going to receive artificial silk fibres at 5000 dollars a ton.

Dutch-German (U.S.S.R. Zone) Trade Agreement.—Chemical raw materials, including superphosphate, and rubber will, *inter alia,* be delivered by Holland to the Soviet Russian occupation zone of Germany against finished chemicals, potash and certain machinery.

German Disinfectants. — The Lingner works of the Deutsche Hydrierwerke A.G., formerly at Dresden (Saxony), have leased a factory in Düsseldorf. The firm is planning to produce disinfectants there, besides resuming the manufacture of chemicals which used to be made at its Berlin factory.

Trade With Berlin.—New regulations by the British and American control authorities permit Berlin exporting firms in future to negotiate contracts direct with foreign buyers. All contracts have formerly been negotiated by the export-import agency. The approval of the agency will still be required.

Austria Making Mining Equipment.—The Alpine Montan Gesellschaft, Austria's leading iron and steel concern, has recently turned to the production of mining equipment. It is hoped that it will be possible not only to replace pre-war imports from Germany, but also to capture former German markets. Orders from Turkey, Bulgaria and Rumania have already been received.

Czech Alcohol Plant for Argentine.—The Skoda Works have orders in hand enough to keep their factories at Hradec Kralove busy for two years. The production programme includes the manufacture of plants for sugar mills, breweries, alcohol distilleries and dairies, and such separate items as separators, milk churns. Among the orders from abroad is one from the Argentine for a large alcohol-distilling plant with a capacity of 55,000 gallons a day, and also from the U.S.S.R. for complete plant for two sugar mills.

New German Potato Process.—A food factory near Leipzig is reported to be operating a new process whereby frozen potatoes can be made edible.

Soda Shortage in Egypt.—According to reports from Cairo, Egypt is experiencing a shortage of soda; output totals some 7000 tons with demand running at 10.000 tons.

U.S. Tung Oil Output Estimates.—According to the U.S. Department of Agriculture, tung oil production is estimated to total from 12,000,000 to 15,000,000 lb. The price of this year's crop will, it is reported, be supported at 25 cents per lb.

Potash Prices.—The American Potash and Chemical Corporation has announced that the price for the fertiliser year from June 1, 1947, to May 31, 1948, for muriate of potash, 60 per cent K_2O minimum, in bulk, carload lots, is 45.5 cents per unit K_2O, f.o.b. Trona, California.

Phthalic Anhydride from Petroleum.—Quantities of O-xylene are being offered by U.S. oil companies for the manufacture of phthalic anhydride. The latter chemical which is a plastic raw material and formerly made from coal tar has been in short supply because of coal tar scarcity.

Varnish From Sugar.—The U.S. Sugar Research Foundation has recently announced a new varnish-like substance, allyl sucrose, which is claimed to be resistant to heat and chemicals. Made from ordinary sugar, it is reported to withstand very high temperatures.

Turkish Chromium Export Difficulties.—Turkey, one of the world's largest producers of chromium, is finding it increasingly difficult to find customers for her yearly output of 200,000 tons. Her present stock already amounts to more than a full year's output and only 70,000 tons yearly can be exported.

U.S. Production of "Carbon 13."—The addition of new equipment to the Eastman laboratories of the Eastman Kodak Co. of America has made it possible to produce "Carbon 13"—used to follow chemical reactions within the body—in 50 per cent concentration, against the previous concentration of 24 per cent.

Solid Fuel—U.S. War Secret.—A solid fuel made from asphalt, and burning with explosive energy, was one of the U.S. wartime secret substances. It was used to get heavily-loaded planes off the ground. The asphalt was mixed with light oil and a chemical, which set free large amounts of oxygen when the asphalt was set on fire.

Oil Exploration in Chile.—Corporación de Fomento de la Produción, Chile, has decided to invest eighty million pesos and two million U.S. dollars in acquiring new oil-drilling equipment and other machinery with a view to intensifying petroleum exploration in the territory bordering the Straits of Magellan.

Swabian Zellstoff Working at 75 per cent Capacity.—The Schwaebische Zellstoff A.G. at Ehingen, whose plants turned out 1300 tons of bleached cellulose fibre during March, increased their output to 1500 tons in April. The firm is now receiving sufficient supplies of wood, pyrites and coal.

U.S. Soap for Germany.—Negotiations are being conducted at present in the U.S. zone of occupation in order to make U.S. Army stocks of soap available to German industry. This soap from U.S. Army stocks has a fat content of 63 per cent. By processing it and thus lowering the fat content, larger quantities will be made available to the German consumer.

German Dye Works to Increase Nitrogen Output.—To achieve a higher production of nitrogen the Hoechst dye works are to build a plant to produce 10,000 tons of lime ammonia saltpetre and 22,000 tons of nitro-phosphates monthly. The increase in production is, however, still dependent on whether a monthly 3600 tons of ammonia can be supplied from the Wesselingen works.

German Glass Wool.—The Deutsche Libbey-Owens Company has taken up the production of glass wool. About 250 tons of glass débris are obtained every month from the large glass blowing works at Lauscha in Thuringia. By a new process this material can now be converted into glass wool for which there is now a big demand in the building trade.

Bicarbonate Shortage.—The present output of bicarbonate of soda in Italy amounts to about 60 per cent of the pre-war level. This amount is by no means adequate to meet the pressing demand of the home market, but nothing much can be done for the moment as the war damages inflicted upon Italian factories have not yet been repaired and because of the shortage of raw materials and coal.

Production of Ammonia in British Zone.—In order to obtain motor spirit with a minimum of foreign exchange, a plan of the Ministry of Economics for North Rhine-Westphalia recommends the import of large quantities of cracked petroleum without delay. According to the Ministry's plan, the Wesseling Works are to produce 3000 tons of ammonia a month. This would give, after processing at the Hoechst Chemical Works, 15,000 tons of fertilisers.

Czech Insulin Production.—The United Pharmaceutical Works, a Czechoslovak nationalised concern, has carried out a rationalisation of the production of insulin, as a result of which the country will be independent of foreign supplies. Raw materials for the manufacture of insulin were formerly sent abroad.

Geology a State Secret.—Disclosure of information about "geological resources and production of non-ferrous and rare metals and rare earths" in the U.S.S.R. is one of the offences under a new Soviet State Secrets law providing for trial by a military tribunal and punishment in a reformatory labour camp.

Syrian Oil Finds.—Good results of oil prospecting in Syria are believed to indicate that the vast oil resources of Arabia and Iraq may extend into Syria. A recent message from Northern Syria reports that high-grade oil has been found a few feet below the surface a short distance from Latakia, and elsewhere the Syria Petroleum Company has started drilling in the Kurdtgh area where rich deposits are indicated.

Canadian Chlorine Plants.—The construction of two new plants in Canada by the Aluminium Company of Canada, Ltd., and the Standard Chemical Co., Ltd., will appreciably increase the Dominion's chlorine production capacity. The Aluminium Company will build a large plant for the production of electrolytic caustic soda and chlorine at Arvida, Quebec. The Standard Chemical Company plans to build an electrolytic alkali unit at Sarnia, Ontario; it will have an annual capacity of 18,000 tons of chlorine.

Canadian Plastics Development.—The Canadian Resins and Chemicals, Ltd., Montreal, is planning to establish the first plant in Canada for the manufacture of dioctyl phthalate. The company also plans to expand its vinyl sheet and film unit to support the project, which is expected to be completed by mid-1948. The development marks an important advance in the Dominion's rapidly-growing plastics industry and will further reduce Canada's dependence upon the United States in the growth of her plastics industry.

Six Monsanto Divisions.—The recent disaster in Texas City has reduced the number of operating works of Monsanto Chemicals, Ltd., in America to 22. Operations are controlled by six divisions—organic, phosphate, plastics, Western and the Texas divisions. The company's research and development problems are handled by the Monsanto Central Research Department at Dayton, Ohio, and the company operates the Clinton Laboratories, Oak Ridge, Tennessee, for the U.S. Government.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Increases of Capital

The nominal capital of **Macleans, Ltd.,** 55-6 Pall Mall, S.W.1., has been increased beyond the registered capital of £1,600,453, by £550,000, in 5s. ordinary shares.

The nominal capital of **Pierson Morrell & Co., Ltd.,** (formerly Barnet Chemical Co., Ltd.) Queen's Road, Barnet, has been increased beyond the registered capital of £15,000, by £5000, in 4000 ordinary shares of £1 and 20,000 ordinary shares of 1s.

The nominal capital of **Essences & Synthetics, Ltd.,** 12 Norfolk Street, W.C.2., has been increased beyond the registered capital (as reduced) of £2840, by £7160, in 71,600 shares of 2s. each (including 42,600 shares previously registered).

The nominal capital of **Beecham Maclean Holdings, Ltd.** has been increased beyond the registered capital of £2,413,119, by £1,150,000, in 5s. ordinary shares, (£536,881 of the new capital is in place of preference shares previously redeemed).

The nominal capital of **Newcastle-upon-Tyne Zinc Oxide Company, Ltd.** (formerly Ouseburn Trading Company, Ltd.), Sunderland, has been increased beyond the registered capital of £90,000, by £50,000 in £1 5 per cent cumulative preference shares.

Company News

Forsters Glass announces a net profit of £68,500, the same figure as the previous year. Distribution has been repeated at the total of 16¼ per cent.

Cooper, McDougall & Robertson have announced a profit of £138,912 for the year, a sum which approximates that for the previous year. A dividend of 8 per cent on the ordinary shares is recommended.

The Natal Portland Cement Company has entered into arrangements with Anglo Alpha Cement, Ltd., whereby it will subscribe for 1,000,000 shares at 7s. 6d. from Anglo Alpha Cement, Ltd.

Crystalate Ltd., has agreed to purchase plant, fittings, stock, etc., from **Mica Products,** a subsidiary of **Swears and Wells.** The transaction will be financed by an issue of ordinary shares to existing stockholders in Crystalate.

Pretoria Portland Cement Company has declared a dividend of 15 per cent, making a total of 27½ per cent for the year to June 30, 1947. The final dividend for the previous year was 12½ per cent, giving a total of 26¼ per cent.

Chloride Electrical Storage Company has announced profits amounting to £761,430, compared with £486,928 for the previous year, and is maintaining a 20 per cent dividend on "A" and "B" ordinary shares.

Clover Paint and Composition has declared a dividend of 7½ per cent, making 10 per cent, for eight months to December 31, compared with 10 per cent for the previous twelve months. Profit for the eight months amounted to £29,812 as against £23,814 for the previous twelve months.

Fricker's Metal and Chemical Co. Ltd., announces a net trading profit for 1946 of £41,819. A dividend of 8 per cent has been declared on the cumulative preference shares. At the forthcoming annual general meeting, a dividend of 10 per cent, and a bonus of 5 per cent will be recommended on the ordinary shares.

Chloride Electrical Storage Co. Ltd., has declared a profit of £761,430 for the year ended March 31 (last year's figure £486,928). Holders of preference stock who received a dividend of 5 per cent last December, will receive a further 5 per cent and a bonus of 10 per cent on "A" and "B" ordinary stock.

B. Laporte, Ltd., chemical manufacturers, have announced a net profit of £147,543 for the year ended March 31, 1947, as against £192,644 for the previous year. A final dividend of 10 per cent, plus a 2½ per cent bonus on the ordinary stock, have been recommended, making a total of 17½ per cent for the year.

British Alkaloids, Ltd., has declared a net profit of £153,462 for the year ended March 31, compared with last year's figure of £166,912. Final dividends of 37.93 per cent on the 8 per cent participating preference shares (making 54.53 per cent for the year) and 75 per cent on the ordinary shares (making 100 per cent for the year) have been recommended.

C. C. Wakefield & Co., the lubricating oil manufacturers, have announced a group trading profit of £1,149,849 for 1946, representing an increase of £436,738 on the previous year. A final dividend of 75 per cent and a bonus of 35 per cent are being paid on the capital of £284,375, making a total of 150 per cent for the year as compared with 110 per cent for the previous year.

New Companies Registered

John Kerr (Detergents) Ltd. (25,366).—Private company. Capital £2000 in £1 shares. Chemical manufacturers, etc. Subscribers: D. J. Mitchell Bolton and Ruth R. Primrose. Registered office: 268 Mathieson Street, Glasgow.

Pestcure, Ltd. (436,595).—Private company. Capital £5000 in £1 shares. Manufacturing chemists, druggists, exterminators of pest from wood, materials and other substances, etc. Subscribers: Mrs. Zena M. Norton and H. Ellis. Registered office: Dacre House, Victoria Street, S.W.1.

H. C. Atkins Laboratories, Ltd. (436,393).—Private company. Capital £100 in £1 shares. To acquire the business of a proprietor of research laboratories carried on by Hubert C. Atkins at 32 Cumberland Road, Kew, as "H. C. Atkins Laboratories." Directors: H. C. Atkins and Edith Atkins. Registered office: 32 Cumberland Road, Kew, Surrey.

Evolite Plastics, Ltd. (436,497).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in thermoplastic and thermosetting plastic mouldings, and articles, chemicals and products manufactured therefrom or utilised therewith, makers and factors of electrical and wireless components, etc. Directors: J. E. Evans and J. H. Oldrey. Registered office: 24 Basinghall Street, E.C.2.

Thames & Mersey Trading Co., Ltd. (436,233).—Private company. Capital £1000 in £1 shares. Merchants and manufacturers of dyes, colours, chemical substances, industrial and other preparations and compounds; pulp and materials used in the manufacture or treatment of paper, etc. Directors: C. Dickson; E. W. Sayers and B. Wilson. Registered office: 7-8 Railway Approach, S.E.1.

Chemical and Allied Stocks and Shares

BUYING interest in stock markets has continued to be held in check by international uncertainties, although the U.S. aid to Europe developments and Mr. Bevin's French visit were helpful influences. British Funds, however, fell back sharply under the lead of 2½ per cent Consols and 2½ per cent Treasury Bonds, "irredeemable" stocks being out of favour in view of the growing belief that Mr. Dalton's cheaper money policy has reached its peak. Another batch of dividend increases helped industrial shares, but movements generally recorded small declines and chemical and kindred shares reflected the general trend.

Imperial Chemical eased to 51s. 10½d., and although active, Monsanto 5s. ordinary receded to 63s. 6d. B. Laporte remained at 105s., and W. J. Bush at 93s. 9d. Fisons have been firm at 67s. 6d. on the dividend increase and market rumours that the full results may give news of important new capital developments.

Among new dealings, Hardman & Holden 5s. ordinary were active; compared with the placing price of 30s. 1½d. they quickly rose to 33s. 3d. Lawes Chemical 10s. shares were 14s. 6d., and Greeff-Chemicals Holdings 5s. ordinary remainder under the influence of the results, changing hands round 18s. 7½d.

Elsewhere, Borax Consolidated eased to 60s. 6d., British Oxygen have been firm at 110s. 7½d., and following the full report, Amalgamated Metal shares have eased to 19s. 9d. Dunlop Rubber after an earlier rise, eased to 79s. British Aluminium were 50s. 4½d., but Goodlass Wall came back to 45s. 6d., and General Refractories were 26s. 6d. On the other hand the schemes for colonial development tended to draw attention to Lever & Unilever, which strengthened to 57s. United Molasses at 58s. 6d. failed to hold all an earlier rise, but in front of the dividend announcement, the units of the Distillers Co. remained firm at 149s. 6d. British Plaster Board were 33s., but elsewhere, Associated Cement have firmed up to 77s. 3d. Low Temperature Carbonisation eased to 5s. 7½d.

Iron and steel shares remained steady, being unaffected by reports that drafting of the Bill for nationalisation is nearing completion. United Steel firmed up to 24s. 9d., Guest Keen were 47s. 9d., and Dorman Long 26s. 3d. Colliery shares receded, Carlton Main declining to 43s. on the company's no liquidation decision. Many of the breakup value calculations which have been current in the market in respect of coal shares have been based on the assumption of liquidation; but where there are non-colliery assets and activities which can yield a profitable income, liquidation would probably not in the best interest of shareholders. Textiles have been dull and uncertain, although J. & P. Coats moved up to 77s. 3d. Courtaulds fell back 9d. to 52s. 6d. on the dividend of 9¼ per cent for the fifteen months to March 31 last although representing a fractional increase over the 7½ per cent rate paid for the previous year, was below most expectations. It is apparent that the company is continuing its policy of conservative finance in order to provide for expansion and development. British Celanese have eased to 32s. 3d.

Elsewhere, Boots Drug have been firm at 63s. 9d. with Beechams deferred better at 29s. 9d. Griffiths Hughes better at 58s. 6d., Timothy Whites 52s. 9d., and Sangers 39s. Triplex Glass at 35s. 6d., were inclined to firm up with motor car shares. Wall Paper manufacturers deferred turned firmer at 57s. 9d. Oil shares failed to hold earlier gains, being influenced mainly by international uncertainties despite the recent dividend increases that have come to hand. Shell were £5¼, Anglo-Iranian £7¾, and Burmah Oil 81s. 3d. Ultramar receded to 70s. on the full report.

Prices of British Chemical Products

THE demand for industrial chemicals has been fully sustained during the past week with perhaps rather more pressure for deliveries under existing contract commitments. The volume of fresh inquiry both for home account and for shipment has been on a good scale and has not been confined to any one section of the market. Firm prices are maintained and reports indicate a possible movement to higher levels. An increase in the price of sodium phosphates has been notified by the makers, the disodium being now quoted at £30 10s. per ton, and trisodium at £35 per ton. Trade in the coal tar products section is without feature, there being a ready outlet for all available supplies. There is a good export demand for A.D.F. cresylic acid, the fulfilment of which is dependent upon a supply of suitable containers, a question which is giving some concern to traders endeavouring to build up an export trade in this product.

MANCHESTER.—Quotations have been maintained throughout the Manchester market for both light and heavy chemicals, though in one or two directions the undertone seems to be not quite so strong, especially in respect of second-hand parcels. Textiles and other leading industrial users are pressing for deliveries, but supplies of soda ash and certain other alkali products are still below current needs and many complaints of shortages, especially from the woollen trade, are reported. In the potash chemicals, and also in the ammonia and magnesia sections, the demand is on steady lines. A brisk movement into consumption in the tar products trade is reported.

GLASGOW.—Pressure of business continued to be very great in the Scottish chemical market during the past week. Considerable volume of business has been transacted both in the home and export market. A number of export orders have been secured and inquiries both in the home and export market continued over the whole range of chemicals. The delivery position has steadily improved and there are signs at long last of returning confidence by foreign buyers. In general the improvement which has been noticed for the past few weeks has continued.

Price Changes

Rises: Antimony oxide, copper carbonate, copper sulphate, lead nitrate, sodium sulphate, sodium phosphate, sulphur, lithopone.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £56 10s.; 80% pure, 1 ton, £58 10s.; commercial glacial 1 ton £70; delivered buyers' premises in returnable barrels: £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 1/5 tons, £86 10s.; single drums, £87 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 galllons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £21 to £25 per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£162 10s. per ton.

Arsenic.—Per ton, 99/100%, £38 6s. 3d. to £41 6s. 3d., according to quality, ex-store.

Barium Carbonate.—Precip., 4-ton lots, £20 per ton d/d; 2-ton lots, £20 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £20 per ton d/d; 2-ton lots, £20 5s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; pow-

dered, **£54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.**

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% **solid, £5 15s. per** ton, ex store.

Charcoal, Lump.—£25 per ton, ex wharf. Granulated, £30 per ton.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, **5⅝d. per lb.**

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6½d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: 1s. 7d. per lb.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£46 12s. 6d. per ton f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £12 14s. 6d. for 10-cwt. lots to **£14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.**

Formaldehyde.—£27 to £28 10s. per ton in **casks, according to quantity, d/d. MANCHESTER: £28.**

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., £6 per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running **crystals are quoted at 2s.** 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d per lb., according to quantity.

Lactic Acid.—Pale tech., £70 per ton; dark tech., £60 per ton ex works; barrels returnable.

Lead Acetate.—White, 95s. to 100s. per cwt., **according to quantity.**

Lead Nitrate.—About £95 per ton d/d in casks. MANCHESTER: £105.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £106; orange lead, £118. Ground in oil; Red, **£132**; orange £144. Ready-mixed lead paint: Red, £140; orange, £152.

Lead, White.—Dry English, in 8-cwt. casks, £116 10s. per ton Ground in oil, English, in 5-cwt. casks, £141 per ton.

Litharge.—£83 10s. to £86 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in **bags, ex works, £36 per ton.**

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 7s. 6d.; smaller quantities dearer.

Mercurous Chloride.—9s. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 4s. 4d. per gal.; pyridinised 64° O.P. 100 gals., 4s. 5d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. **casks. MANCHESTER: £5 to £5 5s. per cwt.**

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton **for 1-ton lots; flake, £76 per ton for 1-ton** lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 9⅝d. per lb.; ground, 10⅝d. per lb., for not **less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.**

Potassium Carbonate.—Calcined, 98/100%, £57 10s. per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 10s. per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £21 to £25 per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 2s. 1d. to 3s. 0d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £18 4s. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 8d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£45 to £47 per ton.

Sodium Hyposulphite.—Pea crystals 22s. 6d. per cwt. (2 ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 15s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£23 per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £30 10s. per ton d/d for ton lots. Tri-sodium, £35 per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£7 17s. 6d. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 12s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 12s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton: pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 12s. 6d. to £16 17s. 6d., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 15s. per ton;; 140° Tw., arsenious, £4 7s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £68 15s.; green seal, £70 5s.; red seal, £71 5s.

Zinc Sulphate.—No quotation.

Rubber Chemicals

Antimony Sulphide.—Golden, 3s. to 4s. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£48 to £51 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d to 1s. 5¾d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £32 17s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in December £20 4s. 6d., rising by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in December £9 18s. 6d., rising by 1s. 6d., per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 6½d. to 9¾d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £8 1s. to £12 13s. per ton according to m.p.; hot-pressed, £14 15s. to £15 14s. per ton, in bulk ex works; purified crystals, £28 to £43 5s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. to 80s. per ton f.o.r. suppliers' works; export trade, £6 15s. per ton f.o.b. suppliers' port. MANCHESTER: 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 2½d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 2½d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—Nominal.

***o*-Cresol** 30/31° C.—Nominal.

***p*-Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—June 15. For the period ending June 28 (July 19, 1947, for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package; LINSEED OIL, crude, £200. RAPESEED OIL, crude, £190. COTTONSEED OIL, crude, £109; washed, £112. COCONUT OIL, crude, £106; refined deodorised, £112; refined hardened deodorised, £116. PALM KERNEL OIL, crude, £105 10s., refined deodorised, £112; refined hardened deodorised, £116. PALM OIL (per ton c.i.f.), in returnable casks, £99 5s.; in drums on loan, £98 15s., in bulk, £97 15s. GROUNDNUT OIL, crude, £110 10s.; refined deodorised, £114, refined hardened deodorised, £118. WHALE OIL, refined hardened, 42 deg., £117; refined hardened, 46/48 deg., £118. ACID OILS, Groundnut, £94; soya, £92; coconut and palm-kernel, £97 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Patents in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each.

Complete Specifications Open to Public Inspection

Polymers of ethylene.—E.I. du Pont de Nemours and Co. Nov. 15, 1945. 33914/46.

Vat dyes of the anthrimide carbazole acridone type.—General Aniline & Film Corporation. Nov. 16, 1945. 33150/46.

Vat dyes of the anthrimide carbazone thioxanthone type.—General Aniline & Film Corporation. Nov. 16, 1945. 33152/46.

Highly stable vinyl polymer latices and method of preparing same.—B. F. Goodrich Co. Nov. 16, 1945. 33575/46.

Apparatus for preventing the accumulation of ice on a surface.—B. F. Goodrich Co. Nov. 13, 1945. 33576/46.

Hydrocarbon conversion.—Houdry Process Corporation. Nov. 15, 1945. 31244/46.

Separating progesterone from cholesterol.—Laboratoires Francais de Chimiotherapie. Nov. 15, 1945. 29740/46.

Processes of preparing isopropenylbiphenyl and the improved products resulting therefrom.—Monsanto Chemical Co. Jan. 20, 1945. 11570/47.

EDUCATIONAL

PATENTS & TRADE MARKS

SITUATIONS VACANT

MISCELLANEOUS

FOR SALE

One Triple effect Evaporating Plant by G. & J. Weir, each evaporator being 4 ft. 3 in. dia. by 6 ft. 9 in. high, cast iron construction: evaporating capacity 200 tons of seawater every 24 hours, fitted internally with 13 banks of copper steam coils, each bank secured into common header, large inspection door to facilitate easy replacement of coils, complete with brass tubular distiller condenser 3 ft. dia. by 4 ft. 10 in. between tube plates: all ancillary equipment including feed, circulating and fresh water pumps, all by above manufacturer; and a quantity oj spare steam coils.

Three complete Triple effect Evaporating Plants by G. & J. Weir with cast iron Evaporators 3 ft. dia. by 6 ft. 9 in. high, evaporating capacity 100 tons of seawater every 24 hours: fitted internally with 10 banks of copper steam coils, each secured into common header, large inspection door to facilitate easy replacement of coils: each unit is complete with distiller condenser 2 ft. dia. by 4 ft. 10 in. between tube plates: all ancillary equipment including combination feed, salt water and circulating pump, and fresh water pump: large quantity of unused spare coils available.

One Single effect salt water Evaporator by Weir, cast iron construction, 2 ft. 6 in. internal dia. by 5 ft. 6 in. high: capacity approx. 20/25 tons of seawater every 24 hours: fitted internally with multi-banks of copper steam coils secured into common cast iron headers: large inspection door to facilitate easy replacement of coils: complete with distiller condenser 4 in. dia. by 2 ft. 10 in. between tube plates: combination brine and fresh water pump and quantity of spare copper coils available.

One Electrically heated water Evaporator by Siemens, capacity approx. 10 tons of seawater per 24-hour day: manufactured in 1943: electric supply being 220 volts, complete with rotary pump driven by 18-h.p. (13.5 kw) D.C. motor by Siemens Schukert, 220 volts, running at 1800 r.p.m. enclosed ventilated machine, ball bearing.

Portable Crushing and Screening Plant by R. H. Marsden Ltd., serial No. D.4, comprising 16 in. by 9 in. Crusher mounted on trailer-drawn chassis with 24 in. by 8 in. front wheels and 30 in. by 8 in. rear wheels. Contents of Crusher discharge into underslung Rotary Screen approx. 8 ft. long by 2 ft. 6 in. dia. with four standard screen sections. Unit driven by horizontal Blackstone Diesel Engine rated at 20 b.h.p. at 550 r.p.m., type OPH. Included with this unit are one set of screens and four jaws, starting handles, spanners, etc., in three cases.

GEORGE COHEN SONS & CO. LTD.
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and STANNINGLEY, Nr. LEEDS

ABOUT 2,000 Cathode Clear Bulbs measuring 17 in. high, 6-in. base dia. by $2\frac{7}{8}$ in. top. Ideal for laboratory use or a host of other applications. Price 5s. each. Apply for full details to Box. No. 2139, G.T.C. Ltd., 82-94, Seymour Place, W.1.

AIR Receivers, 40, dished ends, 4 ft. 6 in. by 22 in. dia. tested 120 lbs. hydraulic, £5 each inspected Hatcham Road, S.E.15. THOMPSON & SON (Millwall) Ltd., Cuba Street, Millwall, London, E.14.

APPROXIMATELY 4 tons Copper Sulphate Commercial, Fine Gran. Price £30 per ton. Sample on request. Box No. 2466, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

CHARCOAL, ANIMAL, and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams, "Hill-Jones, Bochurch, London." Telephone 3285 East.

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MORTON, SON & WARD LTD.
OFFER
FROM STOCK
NEW AND UNUSED PLANT

EIGHT—3000 g.p.h. Worthington Simpson all-gunmetal belt-driven units.
TWO—2500 gall. capacity, 100 lb. per sq. in. pressure Welded Receivers, 6 ft. dia. by 13 ft. 6 in. long.
SEVERAL—100 gall. capacity M.S. Boiling Pans, 3 ft. by 3 ft. dia., 100 lb. per sq. in., certified W.P.
SEVERAL—1100 gall. capacity Rectangular Tanks, 7 ft. by 5 ft. by 5 ft. by $\frac{3}{16}$ in. plate.

HIGH-GRADE USED PLANT

THREE—$1\frac{1}{2}$ in. Holden & Brook Pumping Sets, 1200 gall. per hour with 2 h.p. Flameproof L.D.C. Motors, 400/3/50 cycles with F.L.P. Starter.
ONE—$2\frac{1}{2}$ in. Evans Pumping Set, 3000 g.p.h. driven 2 h.p. Brook Motor with Brook Starter, 400/3/50.
ONE—$1\frac{1}{2}$ in. Beaver Pumping Set, 1000 g.p.h. driven 3/4 h.p. Ball Motor, 400/3/50.
TWO—300 g.p.h. De Laval Type 4024 Industrial Centrifugal Separators, E.E.C. motor $1\frac{1}{2}$ h.p., 400/3/50 and twin pumps. (As new.)
TWO—300 g.p.h. Hopkinson Industrial Separators or Clarifiers with inbuilt motor and pumps 400/3/50, complete with tools, spares, etc. (As new.)
THREE—150 g.p.h. Ditto.
ONE—20 in. Keenok Disc Bar Mill, f. and l. pulley drive. (New condition.)
ONE—200 h.p. Ellison Oil Immersed Starter, 400/3/50.
SEVERAL—250 gall. all-rubber Storage Tanks, approx. 2 ft. 8 in. by 2 ft. by 8 ft. 6 in. long.

MORTON, SON & WARD LTD.
WALK MILL, DOBCROSS, Nr. OLDHAM, LANCS.
'Phone: Saddleworth 437

FOR sale—Large quantity of used activated carbon. Box No. 2478, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

METAL Powders and Oxides. Dohm Limited, 167, Victoria Street, London, S.W.1.

NEW Stainless Steel Vertical Cylindrical Tanks, 25, 50 and 100 gallon capacity, either with handles, or mounted in rubber castored cradle.
Also Stainless Steel Water-jacketed Pans with similar capacity, arranged for heating by water, oil, gas, electricity or steam.
Also Mild Steel Jacketed Pans for 50 lb. and 80 lb. working pressure, 20/300 gallons capacity.
DELIVERY from stock.
Wanted to purchase second-hand chemical plant—best prices given.

THE MANICRAFT ENGINEERING COMPANY LIMITED
Pryme Street Mills, off Chester Road, Hulme, Manchester, 15.

50,000-Ft. Tubular Scaffolding and Fittings.
100 Extension Ladders.
50 Pole Ladders.
50 pairs Builders' Trestles.
50 pairs Decorators' Steps.
1000 gallons Hard Gloss Paint, all shades.
50 tons Washable and Oilbound Distempers.
30,000 ft. Solid Drawn Tubes, 1 in. O/D., $\frac{3}{4}$ in. I/D.
100 tons Angle Iron, 4-ft. and 6-ft. lengths.
50 tons Angle Iron, long lengths.
100 tons Rods, R.S.J.'s, Strips and Corrugated Sheets.
20 Builders' Handcarts.
5000 sheets Asbestos, Corrugated and Flat.

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2 Vertical Stearine Presses
1 Hydraulic Baling Press
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48 in. Belt-driven Hydro
42 in. Under-driven Hydro
Jacketed Mixing Pan, 7 ft. dia., 9 ft. deep
7 various Filter Presses
Ball-bearing Gravity Conveyor, 6 in. pitch, 14 in. wide, 8 ft. lengths
12 Vertical Weir & Hall Steam Pumps
Several small Steam-jacketed Copper Pans
Plant and Frame Filter Press, 19 in. square
Three C.I. Sectional Tanks
Several Ball Mills, 6 ft. 6 in. by 6 ft. 8 in., Silex-lined batch type, with driving gear and clutch
Premier Filter Press by Mather & Platt, 32 in. sq., fitted 26 ribbed plates and 27 frames, bottom corner feed, tap outlets, angle lever closing gear
8¼ size Harrison Carter Disintegrator
2¼ size Harrison Carter Disintegrator
Iwel-Laab size 0 Melter, motorised
Porteous size 3 Grinder with Motor
Two set 2-pair high Breaking Rolls, 33 in. long
One 18-in. 4-roll Cake Cracking Mill
One 36-in. dia. Swan Neck Hydro Extractor
Five Large Filter Presses
One Oram Barrel Hooping Press
Rectangular Storage Tank, 128-tons capacity
Ditto, 108-tons capacity
Ditto, 62-tons capacity
Sectional ditto, 16-tons capacity
Steel Sectional ditto, 10-tons capacity

Write: RICHARD SIZER LIMITED, ENGINEERS CUBER WORKS, HULL

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FOR SALE

Horizontal Cast Iron **RECESSED PLATE TYPE FILTER PRESS** by Donaldson having 28 plates forming cakes 24 in. square by ¾ in. thick, 2 in. centre feed, individual spout run off to each plate, mounted on two tie bars carried on cast iron end castings and closed by means of square thread buttress screw through hand wheel.
Overdriven **CHANGE PAN MIXER** or **WHISK**, comprising gate type mixing gear revolving in opposite directions driven through bevel wheels from fast and loose pulleys ; 15 in. diameter by 2½ in. face ; stainless steel pan 18 in. dia. by 20½ in. deep, carried on hand operated rising and falling platform.
Unused **TIMBER TANK** 3 ft. by 3 ft. by 3 ft 6 in. deep internally, sides and ends of 2½ in. thick timber and base 1½ in. thick ; four ¾ in. dia. tie rods with 3 in. by ⅜ in. thick steel straps.
Single Roll **OINTMENT MILL**, having revolving pan 30 in. dia. by 5 in. deep ; marble scraper and base ; adjustable marble roller 18 in. dia. by 7 in. face ; bevel gear drive ; fast and loose pulleys.

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OVAL-JACKETED Vacuum Oven, 7 ft. by 4 ft. 6 in. by 2 ft. 6 in.
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20-in. Broadbent Electric Hydro, 415/3/50.
26-in. Belt Driven Hydro Extractor.
6 Wood Rectangular Tanks up to 500 galls.
2 Earthenware Stainless Mixers, 250 galls.
HARRY H. GARDAM & CO. LTD. STAINES.

1000 STRONG NEW WATERPROOF APRONS, To-day's value 5s. each, Clearing at 30s. dozen. Also large quantity Filter Cloths, cheap. Wilsons, Springfield Mills Preston, Lancs. Phone 2198.

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BELGIAN Importer and Agent wishes to contact British manufacturers and exporters of Chemicals of the Textile, Paper, Leather, Varnishes, Ink, etc., industries. Excellent connections and references. Correspondence invited to Box No. 2477, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hill-Jones, Bochurch, London." Telephone 3285 East.

LONDON FIRM offers complete service packing powders of all descriptions, also liquids and chemicals. Long runs only. Containers and packing cases for home and export, made on premises. Near to docks. Own rail sidings. Box No. 2331, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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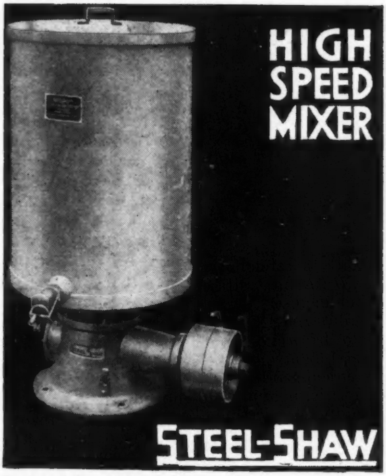

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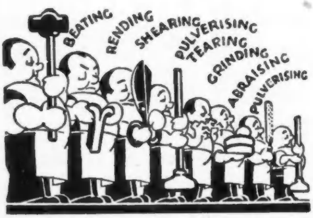

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